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# SCIENTIFIC AMERICAN

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Photograph by Underwood & Underwood

**This powerful "monitor," throwing a six-inch stream under 150 pounds pressure, is widening the canal prism by tearing down the mountain side.**

**PANAMA—IMPRESSIONS OF THE WORK ON THE CANAL.**—[See page 362.]

# SCIENTIFIC AMERICAN

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.


*The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.*

## Personal Impressions of the Panama Canal

WORK on the Panama canal has reached a stage at which the last doubt as to the successful completion of this, the world's most monumental work of engineering, has disappeared from the minds even of the most skeptical. Col. Goethals, Chairman and Chief Engineer of the Canal Commission, recently stated that the first ship will make an experimental passage of the canal in September of next year. Such is the confidence in the ability of the canal force to "make good," that the American public accepts the statement with perfect composure—and this in spite of the fact that the date named anticipates the original estimated time of completion by a year and a quarter.

Skepticism, both professional and popular, as to the ability of the United States to construct the canal by a certain time or within the limits of a definite appropriation, certainly seemed, at the outset, to be justified by a review of the previous history of this apparently ill-fated undertaking. Was not Panama the pest-hole of the tropics, and had not the great de Lesseps, with all the prestige of the Suez canal at his back, gone down to disastrous defeat before the prodigious problems presented by sliding mountains, torrential floods and the ever-present menace of deadly and little-understood tropical diseases?

Furthermore, the early days of American control and construction were disappointing. Two chief engineers, in succession, had resigned, after a comparatively brief control of the work; and there was a lack of harmony throughout the working staff which was ominous and prophetic of future failure.

Then came the transfer of the work to the army engineers, and, after a period of readjustment of forces, the mighty enterprise began to move forward to its completion on a scale and with a certainty which speedily restored public confidence.

Now that the end is in sight, the American people are showing a keen and most intelligent interest in the great work. Evidence of this is seen in the ever-growing tide of travel which is setting toward the Isthmus of Panama.

The canal must be seen to be appreciated. Only by a personal inspection can one gather an adequate impression of the magnitude and difficulties of the work, and the masterly way in which the various problems have been met and solved. It is one thing to read that one single slide in the Culebra cut covers forty-seven acres; it is another thing to stand in the bottom of that yawning excavation, let the eye range far and wide over the vast and curiously contorted side of the mountain, and realize that the prodigious mass is moving remorselessly into the cut, and must be patiently dug out and hauled miles away to the spoil dumps.

With a view to bringing the readers of the SCIENTIFIC AMERICAN into personal touch with the great achievement at Panama, the Editor-in-Chief recently made a lengthy stay at the isthmus, in the course of which he traversed the whole length of the canal, made careful inspection of the work, and came into close personal touch with the men who have transmuted the Panama canal from a dream into a splendid reality. The impressions gathered during this sojourn will be given in a series of articles, the first of which is published on another page of the present issue.

## Cement Troubles in the New Tubes

OUR readers have been informed through the daily papers that signs of trouble have made their appearance in the cement work of the new tunnels of the Lackawanna and Hudson and Manhattan railways and in the open cut of the Erie Railway through Bergen Hill. The extended use of cement on a very large scale and for a great variety of building operations is a comparatively recent development, and as yet there are many problems relating to this which remain but incompletely solved. Among the effects which have caused considerable havoc at different times and in various places in cement construction is the appearance of a more or less clearly defined electrolytic action. While the exact circumstances under which such action becomes a menace to cement constructions are not completely understood, and investigation along this line is still in progress, there is no doubt that some of the damage which has occurred has been due to this cause. In particular in the case of the cement work of the tunnels and cutting mentioned above, it is suspected that electrolytic action is at the bottom of the disintegrations which have been observed. While the exact circumstances which have led to the corrosion observed are to some extent a matter of mystery, at least as far as the public are concerned, it is understood that a probable cause is electrolysis due to stray currents through conductors carrying heavy currents, in the presence of sulphur compounds, which presumably are derived from the rock through which the tunnel and cutting are constructed. A commission has been appointed to investigate the condition, and it is expected that a report will be forthcoming in a few weeks' time. The interest attached to this case is very considerable, not only on account of its own importance, but also in view of its bearing on the general question of the disintegration of cement constructions under the action of electrolytic and possibly other causes. The report of the commission will be awaited by all with much interest.

## Abbott Lawrence Rotch

IN the untimely death of Lawrence Rotch, which occurred on April 7th, the scientific world of America has lost a zealous worker and a liberal patron. To the present writer, who was occasionally thrown into intimate contact with him, he always seemed, despite certain frailties of temperament, a particularly inspiring example of a type of man deplorably uncommon in this country, and much more common in England than anywhere else. Possessed of an ample fortune and a cosmopolitan education, he elected to lead a life both scholarly and useful; eschewing on the one hand aimless pleasure-seeking, and on the other the commercial activities to which an unfortunate national tradition relegates the great majority of Americans whose material circumstances make a gainful occupation a pastime rather than a necessity.

Rotch was the foremost amateur meteorologist of the world. His pet hobby took shape in the Blue Hill Observatory, than which no private scientific institution enjoys a higher or more deserved reputation. Founded in 1885, this observatory has always been a most valuable supplement to the official weather service of this country. While the work of the latter is more or less circumscribed by the utilitarian considerations which are inseparable from government control, Blue Hill has been free to realize the ideals of pure science. With a brilliant staff, partaking of their director's enthusiasm, and with an intimate knowledge of the trend of ideas in his science, gained by frequent visits to foreign institutions and regular attendance at international meetings, Rotch was able to keep his observatory abreast of the times. Moreover, he occasionally set the pace with pioneer work which brought him great honor at home and abroad. Thus he developed the technique of the meteorological kite, thereby laying the corner stone of the fascinating twentieth century science of aerology—the exploration of the upper air. A natural expression of his progressiveness was the fact that, like so many of his meteorological colleagues abroad, he devoted much attention in recent years to the advancement of aeronautics.

European meteorology still enjoys the disinterested services of Teisserenc de Bort, Dines and Schuster. What man of independent fortune and adequate scholarly attainments will take the place of Rotch in this country?

## Our Lying Senses

ALMOST all training of the senses in children is subconscious and self-attained—generally in games and at play. A certain amount, also, of such training is done methodically in schools. Thus, there are two tests of the sight sense: the event test and the picture test. In the first a fully enacted scene is presented before a witness; and either immediately or soon after the event he is asked to recall and describe what he has seen. The picture test was first demonstrated in America at Clark University, by Prof. William Stern of Breslau, the pioneer in this field. By this test a picture is shown the subject for a brief period, after which he describes what he has seen, and is further questioned, as in the event experiment. It is now purposed to combine these in the moving picture test.

We may not here consider further these tests, except to observe how they demonstrate that people do not see a fraction of the things they confidently believe they see; and that one person's report of what he has seen almost never coincides, not even in the main, with another's report. And yet here is demonstrated no new thing. Historians and students of human affairs find hopeless discrepancies among eyewitnesses of a given battle or any other great event. Seeing is by no means always believing. The statement of a perception can be sound only when the latter has passed muster before dispassionate reason. And it is amazing how much an individual's temperament oftentimes colors a simple fact. The senses are by no means invariably a sure guide; the very best they can do is to appreciate phenomena. Reality, that is indubitable fact, is possible only when emotionless reason, bringing memory and experience to bear upon the perception conveyed to the cerebrum, has given judgment.

## Corrosion of Iron by Electrolysis

IN order to settle the question as to whether, under all conditions, iron is corroded by the passage of current from it into the ground, experiments were conducted in the research laboratory of the General Electric Company. These experiments led to some very interesting discoveries. Sheet iron plates were immersed in a one per cent solution of ammonium nitrate, and when current was passed through them the corrosion was found to be considerably less than was theoretically called for. It was suspected that there were periods of partial corrosion, but further investigation showed that the iron was either in a "passive" or in an "active" condition with no intermediate state. During the passive state not only was the corrosion far less than the theoretical, but it was even considerably less than the chemical corrosion unaided by electrolysis, showing that certain conditions existed which actually protected the anode from corrosion. During the active state the voltage was only one volt, but it increased to 2.7 volts in the passive state. While the anode showed no corrosion during the passive state, the cathode corroded about twice as rapidly as before, but even in this case it was but 20 per cent of the normal chemical corrosion.

Experiments were then tried with different electrolytes, which brought forth the following conclusion, namely, that when ferrous compounds were formed, as with chlorides and sulphates, active corrosion took place, while with electrolytes, such as bichromates, in which ferric compounds were formed, the iron remained in a passive state. If nitrates were used giving unstable ferrous salts, either an active or passive state might result. Corrosion would begin as the ferrous compounds were formed, but when these changed to the ferric state the corrosion would practically cease.

Efforts were then made to discover a means of checking the corrosion by adding neutralizing solutions to the electrolyte, but it was found that while the passive state could be destroyed by adding ammonia and chloride in moderate quantities, activity could not be destroyed except by using excessive amounts of bichromates and nitrates. Chlorides were found to be twenty-five times more powerful than sulphates in bringing about the active condition.

A final experiment was made to determine whether the iron would be protected by alkaline reactions. A set of cells was made up with a one per cent solution of ammonium chloride for the electrolyte, and another with a one per cent solution of ammonium sulphate. These were treated with slack lime in one case and powdered chalk in the other. While the chalk did not appear to prevent activity, the slack lime in the cells using ammonium sulphate reduced the activity 58 per cent, while in the ammonium chloride cells it reduced the activity only six per cent.

## Engineering

**Electricity on the Panama Canal.**—At Gatun locks, in raising a ship 85 feet from sea level to lake level, 98 electric motors will be in operation twice during each lockage. These motors will be employed in lowering four fender chains, operating six pairs of gates, opening and closing eight pairs of gate valves and 30 cylindrical valves. The above number of operations of motors may be increased to 143 under certain conditions of the gate valves and other operating devices.

**Important American Bridge Contract.**—The well-known ability of American bridge builders to construct and erect bridges in shorter time and for a lower cost than the rest of the world has again been demonstrated—this time in connection with a competition for a State railway bridge over the River Jumna near Allahabad, India. Twelve leading bridge-building concerns competed, and the award was given to the Phœnix Bridge Company, whose bid was 26½ per cent less than that of the lowest British tender.

**Economy of Electrical Concentration.**—In a recent address before the Institute of Electrical Engineers in this city, Samuel Insull advocated concentration in generating electrical power, and he asserted that if such a system as he proposed were widely adopted there would be an enormous annual saving of coal in the United States. A less amount of energy, he stated, would be required to electrify all the steam railroads in and around New York, if it were done under one concentrated system, than is needed to run the existing separate electric light and power plants in the same territory.

**Oil Consumption on the "Selandia."**—Indicator diagrams taken during the first voyage of the motor-driven steamship "Selandia" show that the mean effective pressure was 91 pounds per square inch at 129 revolutions per minute. This gives the indicated horse-power for the eight cylinders as 1,190, or, assuming 84 per cent mechanical efficiency as obtained on the test bed at the works, this would give 1,000 brake horse-power. Fuel consumption was about 0.45 pound per brake horse-power per hour. The cargo-carrying capacity, owing to the absence of coal bunkers and boiler rooms, has been increased by 1,000 tons, and only two engine-room officers are required on each watch.

**The Mississippi Floods.**—In spite of the great amount of work being done by the Federal government for the control of the Mississippi River, the disastrous flood which is now devastating certain sections of the Mississippi valley proves that we are far from having mastered the situation. The present outbreak of the river will serve to direct attention to a proposed method of control which we are inclined to think will prove to be the ultimate solution of the problem. We refer to the plan of providing storage reservoirs in the upper reaches of the river, in which the flood waters, due to spring rains and the melting of the snows, could be impounded, to be released in the dry season for the purpose of maintaining the river at a navigable depth.

**Fuel Oil and the Battleship.**—Fuel oil is destined to exercise a powerful influence on the design of future battleships. The oil-fuel era will be marked by two distinct stages. During the first stage oil will take the place of coal for raising steam in the boilers. Its experimental use in torpedo-boat destroyers has given such excellent results, that it is now to be used (as we showed in a recent issue) in the boiler rooms of our latest battleships, the "Nevada" and "Oklahoma." Before many years oil will be used exclusively for steam-raising on naval vessels. Then will follow the era of the internal-combustion engine, in which the fuel will be burned directly in the cylinders. The experimental work, both here and abroad, gives great promise of the ultimate application of the heavy-oil engine to battleship propulsion; but it will be some years before the first motor-driven battleship is in commission.

**The "San Marcos" Again a Target.**—In spite of the fact that the old "Texas" formed part of the blockading fleet at Santiago and took part in the battle which destroyed the Spanish fleet, it is a fact that under her new name of "San Marcos" when serving as a target she has proved far more valuable to the navy than during the years of her checkered career of active service. The first attack upon the "San Marcos" was made last year, when the "New Hampshire" demonstrated the efficiency of gun-fire at long ranges. The old ship was sunk during that attack and the evidence of the deadly character of modern shell fire surprised even the ordnance experts of the navy. Subsequently the old hulk has been bombarded several times by various ships of the navy and notably by the "Delaware." The last practice of this kind occurred early this month when the vessel was subjected to heavy gun attack by the ships of the Atlantic fleet. Theoretically these successive bombardments could never occur; for the "San Marcos" was sent to the bottom early in the first attack by the "New Hampshire."

## Science

**Dr. Sven Hedin** is organizing a new exploring expedition in Asia.

**The Return of the Japanese Antarctic Expedition.**—Lieut. Shirase returned on March 23rd to Wellington, New Zealand, from the Antarctic regions. Shirase headed one of the five expeditions which were competing in the race for the South Pole. Shirase had no news of Capt. Scott. What results he has attained it is of course too early to state.

**Ostwald's "Brucke."**—Prof. W. Ostwald has been elected president of the newly-founded International Institute for Research Work, whose headquarters are at Munich. This institute is known as "Brücke," and is likely to be valuable, the more so that the funds which were lacking are to be supplied by a donation of $25,000 made by Prof. Ostwald. This he took from the amount of the Nobel prize which he received.

**Resignation of Dr. Ira Remsen.**—Prof. Remsen, who has been president of Johns Hopkins since 1901, has sent his resignation to the board of trustees of the university to take effect at the end of the academic year. In his letter Dr. Remsen writes: "We are face to face with new problems which will require wise consideration for many years to come. It is not to be expected that I shall be able to guide the policies which are to be inaugurated for a sufficient length of time to insure their ultimate success. I therefore feel that they should be intrusted to one having a reasonable expectation of long term of service."

**Grafting a Cornea on a Blind Eye.**—Dr. Magitot has been engaged upon interesting work at Paris in the way of grafting of the human cornea upon the eye of a blind man. A young man of fifteen years had almost lost the sight of one eye from a burn by quick lime, and an opaque layer covered all over the cornea so that all light was cut off from the retina. Seven months ago Dr. Magitot cut in the middle of the opaque tissue an opening of about 1/5 inch square and then fitted in a miniature window pane in the shape of a square piece of transparent cornea. This he had taken from the eye of another person eight days before. The tissues joined up completely about a week after, and the person thus partially recovered his sight. It is to be remarked that the piece of cornea was preserved in the living state before the grafting process according to a method similar to the one followed in America by Dr. Carrel.

**The Rousseau Institute.**—The J. J. Rousseau Institute is not what its name would imply. When opened it will be devoted, not to the promulgation of Rousseau's notions, but chiefly to pedagogical research. Here professional teachers, students who are specializing in some field of pedagogy, and men and women whose careers are in some way connected with teaching, will find both a school and a center of research. Every student will be trained for personal work in a strictly scientific way, so that when he graduates he may be able to engage not only in his chosen profession of teaching, but in scientific research as well. The curriculum thus outlined is novel. Psychology, to be sure, is taught in every college in the world, but at the Rousseau Institute the student will learn all that is essential of general and juvenile psychology, and will be given a chance to work in a psychological laboratory and to familiarize himself with school anthropometrics, school hygiene. Moreover, he will be taught much that a teacher ought to know of children's diseases, of the care of backward and abnormal children, and of infant crime.

**Portraits of American Association Presidents.**—Dr. Marcus Benjamin has just been informed that his valuable collection of the portraits and autograph letters of the presidents of the American Association for the Advancement of Science received the award "diploma d'honore" from the exposition that was held in Turin, Italy, last summer. It is interesting to add that in 1887 the American Association for the Advancement of Science met in New York city, and for the SCIENTIFIC AMERICAN Dr. Benjamin furnished a portrait with a sketch of Prof. Edward S. Morse, the retiring president of that meeting and now the oldest living past president of the association. From that time until the present Dr. Benjamin has furnished a portrait and sketch of each president to the SCIENTIFIC AMERICAN which has appeared each year in this issue for the week during which the association met. Dr. Benjamin realizing the value and interest of a complete collection of these eminent scientists undertook to secure a portrait and letter from each of the older presidents. These he succeeded in accumulating after some years' work, although not without considerable difficulty; for autograph letters of many of the older scientists, such as those of Louis Agassiz and John Torrey are not easily procurable. This collection was also exhibited at the Louisiana Purchase Exposition that was held in St. Louis in 1904 where it gained for its owner an award of a silver medal.

## Aeronautics

**Aeroplanes in the French Maneuvers.**—As many as 120 aeroplanes will take part in the coming 1912 French army maneuvers, along with the unprecedented number of 140,000 men, or one-fifth of the total army. The aeroplanes comprise twenty sections, or "escadrilles," of eight aeroplanes each. At present the war department is engaged in laying out the plans for the maneuvers in which the aeroplanes will make all the combinations which appear to be useful.

**Popular Subscription for Aeroplanes in France.**—*Le Matin*, one of the leading French newspapers, is conducting a popular subscription for military aeroplanes, and in one month has raised over half a million dollars. Including a separate national subscription fund, the total raised thus far is nearly $600,000. Italy is following suit with a similar popular subscription, and doubtless Germany will be the next in line and will raise money quickly in this way for aeroplanes the same as was done for Zeppelin dirigibles a year or two ago.

**New Meterological Laboratory in Germany.**—A scientific laboratory and observatory for the investigation of the upper layers of the atmosphere is about to be erected near Rostock on the eastern sea coast of Germany. The directorship of technical affairs will be in the skillful and experienced hands of the well-known aeronaut, Capt. A. D. Hildebrandt. The university professor, Herr Kümmel, will have charge of the scientific department. In connection with this institute an aeronautic manufactory will be established and a haven for aircraft of various kinds will be built. For the building of hydro-aeroplanes especially admirable conditions are found in Rostock, since the airmen have no such constriction of territory as is necessary in naval harbors. The Councilor of Rostock has already offered a site, and the city council will support the enterprise.

**Tabuteau's Two-hour Record and Cross-country Flight.**—On February 28th Tabuteau, with a 50-horse-power Morane-Saunier monoplane, beat by 29.144 kilometers his second best previous two-hour record. The new record is 234.431 kilometers (145.66 miles). In 2:07:4 1/5 Tabuteau covered 250 kilometers (155.34 miles), breaking the previous record of 2:22:57 3/5. Not content with aerodrome records, M. Tabuteau, on March 11th, flew from Pau to Villacoublay, near Paris (410 miles) in 4¾ hours, at an average speed of 86.31 miles per hour. He covered the 230 miles between Pau and Poitiers (where he stopped for lunch) in 2 hours and 20 minutes, or at an average speed of 98.57 miles per hour. Thus he succeeded on a cross-country flight in averaging for 2 1/3 hours about the same speed as Vedrines maintained for 1 hour on an aerodrome.

**The First Annual Aeronautical Exhibition.**—The Aero Club of America will hold in the new Grand Central Palace in New York city, from May 9th to May 18th next, its first annual International Aeronautical Exhibition. Through its representatives in Europe the club has invited the co-operation of foreign governments, inventors and manufacturers interested in the development of the dirigible and the aeroplane, and already it has the assurance of the heartiest support from the foremost aeronautical authorities of Great Britain and the Continent, as well as the leaders of aeronautics in America. The committee in charge intends to conduct the show along the lines of the successful Paris Aero Salons, broadening the scope as much as is deemed advisable, though strictly on aeronautic lines. Completed apparatus for aerial locomotion, including balloons, dirigibles, and aeroplanes, will be shown, while interspersed with the aerial craft will be booths for the exhibit of accessories for all methods of air travel. Space on the main floor has been allotted for the display of trophies.

**A New Height Record With Two Passengers.**—The latest height record with two passengers is 2,125 meters (6,970 feet), made by Franz with a Savary biplane and 70-horse-power Labor-Aviation motor, on March 26th. Starting at 8:45 A. M., Franz climbed steadily for 1¾ hours before attaining this great height. He volplaned to earth again in but 5 minutes. The previous record was 2,100 meters, made by Prevost on a 100-horse-power Gnome-engined Deperdussin monoplane. The Savary biplane is an advanced type of double-surface machine having a monoplane body extending to the rear, with motor and twin propellers in front. The propellers run in opposite directions, yet are driven by a single chain which runs over sprockets so arranged as to reverse the direction of rotation of one propeller without crossing the chain. If the chain should break, both propellers would stop. The Labor is a 4-cylinder water-cooled motor of 100 millimeters bore by 210 stroke. It develops 74 horse-power at 1,350 revolutions per minute, and weighs complete with radiator about 7 pounds per horse-power. It won the prize in the French motor competition last fall.

Portrait of Aviator Rodgers, and wreck of his Wright biplane.

View of Monaco taken from the winning hydro-aeroplane.

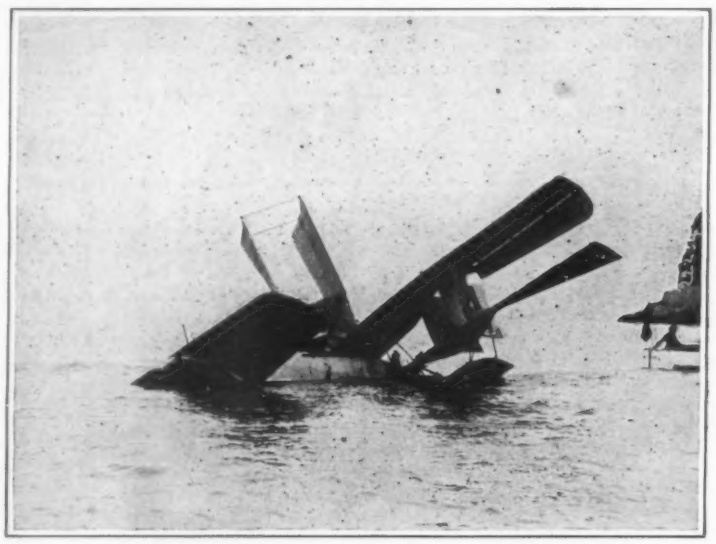
## Fatal Accident to Calbraith P. Rodgers

WHILE making an exhibition flight above the Pacific Ocean near the point where he finished his great transcontinental flight from the Atlantic to the Pacific, Calbraith P. Rodgers on April 3rd fell to his death when only a few yards from shore. He had been out over the ocean for a considerable distance and had ascended to between 200 and 300 feet. As he approached the shore, he gradually descended and was seen for a moment with his hands off the levers, a trick he was wont to accomplish, as he had been known to rest his head in his hands for several minutes while flying, even in a wind. Suddenly, his Wright biplane dove and struck in the surf where the water was only a foot or two in depth. Rodgers, who was well over six feet in height, was doubled under the machine and engine which fell upon him; his neck was broken and he died almost instantly.

This tragic end of the first man to fly across the continent is deplorable. Rodgers, in his record flight, left Sheepshead Bay on September 17th last, and was 49 days covering the 3,350 miles from that point to Pasadena. In flying the few miles remaining, he had a bad fall and broke his ankle, as the result of which he was delayed another month, before he finally reached the Pacific. Throughout the trip some 13½ days were lost in making repairs, 2½ of these being lost in making repairs to the engine, while 11 days were lost on account of the weather. Deducting these various losses, 24½ days was the actual time taken by Rodgers in making the flight, although his time in flight figured up at but 3 days, 10 hours, 4 minutes. At the present writing no explanation has been received as to the cause of this latest fatal accident. Rodgers is known to have been rather careless in his flying, and it would seem as if the accident, if not due to this cause, was the result of the breaking of a control or the stalling of the machine in recovering from a dip and making a sudden rise.

Our illustration shows the wreck of his machine as it lay in the water only a few hundred feet from the point where he finished his triumphant flight last December.

Caudron "headless" biplane equipped with disk wheels and Fabre floats.



Three-quarter front view of wrecked Voisin "Canard."

The elevator is seen at the front (left hand) end of the long body, and a cylinder of the motor at the rear. Note twin rudders at rear and single aileron on upper plane. These were duplicated on other side.

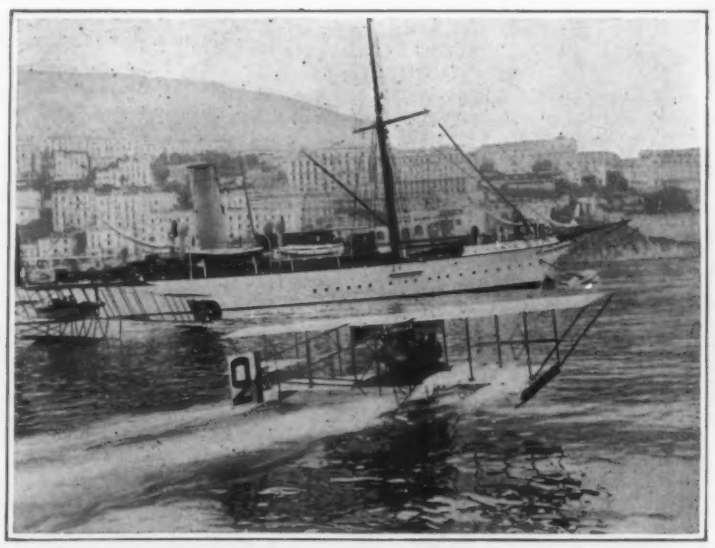
## The First Hydro-aeroplane Meeting at Monaco

AS a preface to the ninth International Motor Boat Races at Monaco this year, a hydro-aeroplane competition was carried on for one week from March 24th to 31st. Some seven biplanes took part in this contest, all of them being French machines with the exception of two Curtiss hydro-aeroplanes piloted by Hugh Robinson and Louis Paulhan. The contests were carried out under an arrangement of points and consisted of various demonstrations. As this was the first hydro-aeroplane competition that has ever been held, it was somewhat difficult to draw up rules fair to all. Getting off the water with the greatest number of passengers was made the chief performance. By accomplishing this with one, two, three, or four passengers, each aviator was given 30, 50, 75, or 100 per cent additional to the points he would score alone. There were in all six tests to be made as follows: A and B, starting from and landing upon smooth water (1 point each); C (2 points) and D (3 points), the same in rough water outside the harbor; and E and F (4 points each), running up on the beach and starting from it without getting the feet of the aviator or any of his assistants wet.

(*Concluded on page 368.*)

Reneau, the winner, with two passengers in the Maurice Farman biplane.

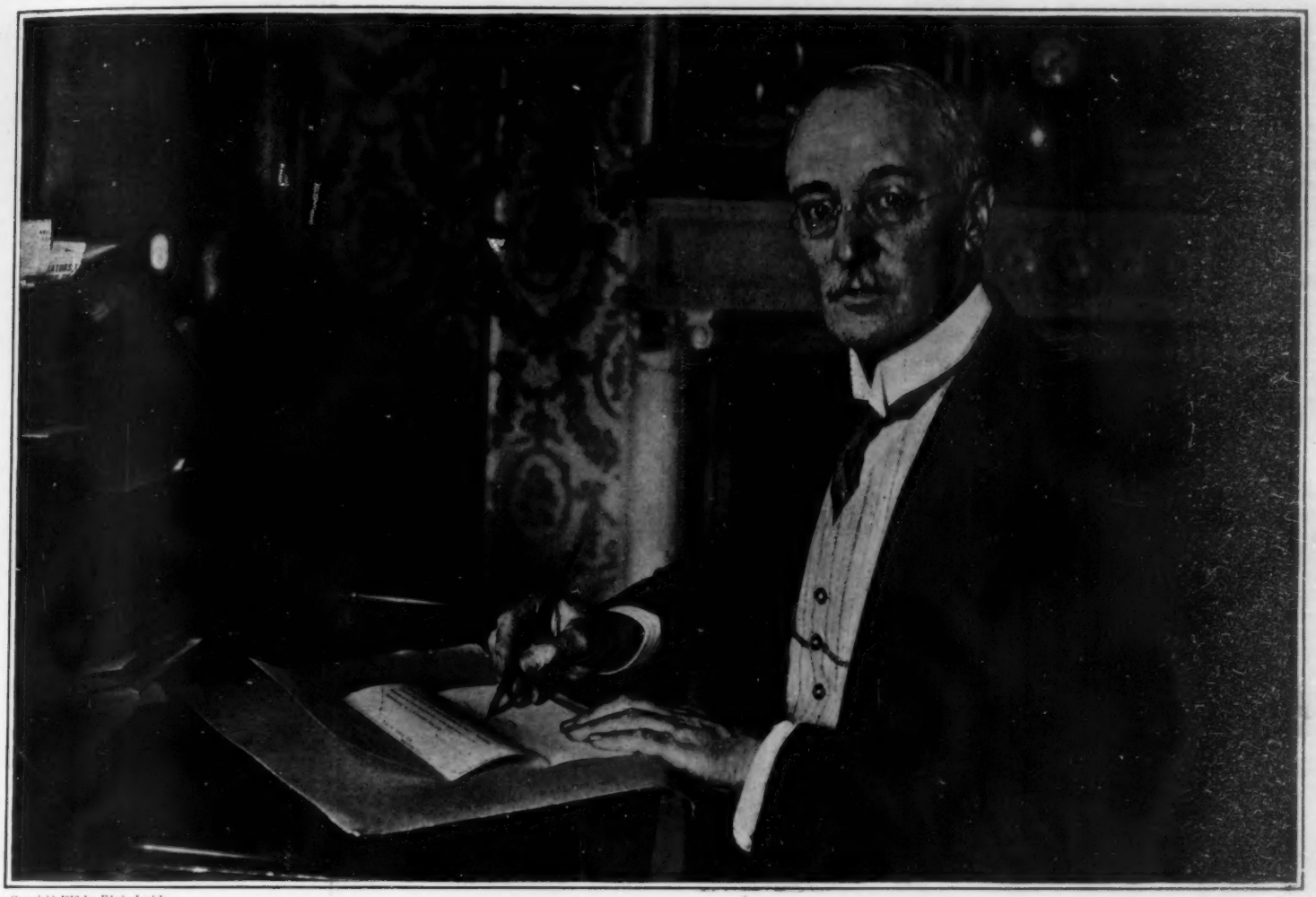
Note the peculiar wedge-shaped floats on this huge biplane, which has a 65-foot spread. It rose from the water with five men aboard—a total weight of 1200 pounds.



Start of Robinson in the Curtiss hydro-aeroplane.

This American machine was the only one with a single float. It has been able to get off and alight upon extremely rough water without difficulty.

DEATH OF TRANSCONTINENTAL AVIATOR RODGERS AND THE HYDRO-AEROPLANE MEET AT MONACO



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Dr. Rudolf Diesel, the inventor of the Diesel engine.

# The Diesel Oil-engine and Its Industrial Importance

## The Simplest and Most Efficient of Motors

### By Dr. Rudolf Diesel

[*BEFORE he sailed for the United States Dr. Rudolf Diesel read before the Institute of Mechanical Engineers in London a remarkable paper in which he pointed out the economic significance of his wonderful engine. The following abstract of that paper may serve to show American readers that a motor which has a thermal or indicated efficiency of 48 per cent and a brake efficiency as high as 35 per cent of the heat value of the fuel is not simply a formidable rival of the time-honored steam engine, but a piece of machinery which may mean much in the industrial development of such coalless regions as Texas, which are rich in oil.*—EDITOR.]

Since its first appearance about fourteen years ago the Diesel engine has been built by the thousand in the best factories of all industrial countries, and has been set up in the most remote corners of the world. It has been proved to be a most reliable engine when properly built, the working of which is quite as safe as that of any other system of prime mover; and in general it is even more simple, since it does not require any auxiliary apparatus, and since the fuel in its natural and original form, without having previously undergone any transforming process, is directly converted into work in the cylinder of the engine. As early as 1897, when, after four years of difficult experiments, the author had put the first engine into working order in the factory of the Augsburg Works, numerous engineering representatives and experts who came from various countries to examine this engine expressed the opinion that it gave better heat utilization than any known kind of heat engine. From experience gained subsequently by working many engines, by gradual improvements in the construction and manufacture, and by increasing the sizes, the results have been still further improved, and to-day the thermal or indicated efficiency reaches 48 per cent in this engine, and the effective or brake efficiency reaches, in some cases, 35 per cent of the heat value of the fuel.

The Diesel engine is an engine which converts the heat of the natural fuel into work in the cylinder itself, without any previous transforming process, and which utilizes it as far as the present standard of science permits; it is therefore the simplest and, at the same time, the most economical prime mover.

These two facts explain its success; it lies in the new principle of the internal working process and not in constructional improvements or alterations of older types of engines. There is no doubt that the careful working out of all the constructional details also plays a great part in the practical success of the Diesel engine, as in any other; but they are not the essential points, and above all they do not constitute the great importance of this engine to the world's industry.

A further reason for this importance is that the Diesel engine has broken the monopoly of coal, and has solved the problem of using liquid fuel for power production in its simplest and most general form. It has become for all natural liquid fuels what the steam-engine and gas-engine are for coal, but in a much simpler and more economical way. The truth of this statement was strikingly proved at the Turin Exhibition of last year. At this exhibition, in the large Machinery Hall, a steam-turbine and a large Diesel engine, both made by Franco Tosi, of Milan, and set up on the same stand, were worked together with the same liquid fuel. The boilers belonging to the plant were fitted with Körting nozzles for burning crude oil. The difference between the two plants was therefore this: for the working of the steam-engine the whole boiler plant with its chimney, fuel supply apparatus, purification plant for feed-water with feed-pumps, extensive steam-pipes, condensation plant with water-pumps and an enormous water consumption, had to be provided, with the final result of consuming 2½ or more times the fuel per horse-power required by the Diesel engine standing beside it. The latter being an entirely independent engine without any auxiliary plant, took up its crude fuel automatically and consumed it directly in its cylinders without any residue or smoke. A better proof can hardly be imagined, even for the non-technical man, that except in special cases, the steam-engine cannot compete economically with the oil-engine, and from this point of view the power-plant in the Machinery Hall at Turin must be looked upon as marking a historical event. It is hardly possible for a country which produces no coal, like Italy, to develop a great industry based on the steam-engine, and this is one reason for the exhibition at Turin of about thirty Diesel engines of various types and sizes, and made in different countries.

Thus the Diesel engine has doubled the resources of mankind as regards power-production, and has made new and hitherto unutilized products of nature available for motor power. The Diesel engine has thereby exercised a far-reaching influence on the liquid-fuel industry, which is at the present time improving more rapidly than was previously conceivable. This is not the place to discuss the matter in detail, but the author wishes to mention that, owing to the interest which petroleum producers have taken in this important question, new petroleum sources are continually being developed; and new oil districts discovered. Moreover, it has been proved by recent geological researches not only that there is probably on the globe as much, or perhaps even more, liquid fuel than coal, but also that it is more conveniently distributed as regards its geographical position. These facts, which are indisputable nowadays, have gradually silenced those who objected to too great a development of the Diesel engine for fear of insufficient stores of liquid fuel. Any such anxiety may be relieved by the fact that the world's production of crude oil increases at present 3½ times more quickly than the production of coal, and that the ratio of increase itself is steadily getting higher. Further, that 40 per cent of the present production of mineral oil is already sufficient to supply the whole of the naval and mercantile fleets of the world with power, if they were worked by Diesel engines; also that with the world's present production the number of Diesel engines now working could be increased about a hundredfold. It may thus safely be asserted that, with the continual development of new oil-districts, the production of mineral oil will increase much more quickly than the demand for newly-built engines.

But with all this, the influence of the Diesel engine in the world's industry is not exhausted. As early as the year 1899 the author utilized in his engine the by-products of coal distillation and coke plants, such as tar and creosote oils, with the same satisfactory results as with natural liquid fuels, but at that time the quality of these oils was generally too inferior for their use in the Diesel engine, and they were, moreover, subject to continual variations. It is only in recent years that the chemical industries interested in the matter have, by improved methods of fractioning and refining, combined with more careful selection of the material, succeeded in supplying fuel of a constant and regular

quality, without the drawbacks of the crude tar-oils used previously. These products—the tar and tar-oils—are thus to-day definitely brought into the sphere of activity of the Diesel engine.

From what has been just stated, it will be seen that the Diesel engine is having an increasing influence on two other industries—the manufacture of gas and coke—the by-products of which have become so important for power production that an enormous business is at present connected with them.

It is especially noteworthy that every town gas-works with a modern installation, and every coke-works, can be completed with an electric power generating plant by using its tars. This will have an excellent effect on many municipal and national works. It would take too much time to enter into the details of this question, but one fact stands out clearly in this connection, namely, that coal, which seemed to be most threatened by the liquid fuels, will, on the contrary, gain a new and wider ground of application through the Diesel engine. As tar and tar-oils are from three to five times better utilized in the Diesel engine than coal in the steam-engine, a much better and more economical utilization of coal is obtained if, instead of being burned under boilers on grates in a wasteful way, it is first transformed into coke and tar by distillation. Coke is used for metallurgical and other general heating purposes; from a part of the tar the valuable by-products are first extracted, and undergo further processes in the chemical industry, while the tar-oils and combustible by-products, and a great part of the tar itself, are burned in the Diesel engine under extraordinarily favorable conditions.

The proper development of the utilization of fuel, which has already been started, and is now making rapid progress, is therefore the following: On the one hand liquid fuel in Diesel engines, and, on the other hand, gas fuel also in the form of gasified coke in the gas-engines; solid fuel as little as possible for steam-power generation, but only in the refined form of coke for all other heating and metallurgical purposes.

The list of fuels applicable to the Diesel engine is not, however, exhausted with these liquid fuels mentioned previously. It is known that brown coal or lignite, the production of which is about 10 per cent of the pit-coal production, also yields tars by distillation, and these tars when distilled, when worked up on paraffin, produce the so-called paraffin oils as by-products. Not all kinds of brown coal, however, are suitable for this process; but, in any case, these oils have been produced in such quantities that so far they have satisfied a good part of the German demand for liquid fuels for Diesel engines. To these must be added other products, such as shale and similar oils—produced not in great but in sufficient quantities to be of importance for power generation. Some countries—France and Scotland for instance—possess them in considerable quantities, and they are used in a good many Diesel engine plants.

It is not generally known that it is possible to burn fat vegetable oils and animal oils in the Diesel engine.

At the Paris Exhibition in 1900 there was shown by the Otto Company a small Diesel engine which, at the request of the French government, ran on peanut oil, and worked so smoothly that only very few people were aware of it. The engine was constructed for using mineral oil, and was then worked on vegetable oil without any alterations being made. The French government at the time thought of testing the applicability to power production of the peanut, which grows in considerable quantities in their African colonies, and which can be easily cultivated there; because in this way the colonies could be supplied with power and industry from their own resources, without being compelled to buy and import coal or liquid fuels.

Similar successful experiments have also been made in St. Petersburg with castor-oil; and animal oils, such as train-oil, have been used with excellent results. The fact that fat oils from vegetable sources can be used may seem insignificant to-day, but such oils may perhaps become in course of time of the same importance as some natural mineral oils and the tar-products are now. Twelve years ago the latter were not more developed than the fat oils are to-day, and yet how important they have since become.

One cannot at present predict what part these oils will play in the colonies in the future. In any case, they make it certain that motor power can still be produced from the heat of the sun, which is always available for agricultural purposes, even when all our natural stores of solid and liquid fuels are absolutely exhausted.

## A New Towing System for Canals

A NOVEL towing system is being tested on a small section of the Dortmund-Ems canal, in Germany. A flexible rail is laid at the bottom of the canal, and the tugboat carries beneath it four rollers by which the rail is clasped, and by which the boat pulls itself along. Any kind of motive power will be available for use by the tugs, but it is intended to install a trolley wire along the bank of the canal, so that electricity would probably be the usual mode of operation.

## The Safety of Smokeless Powders

**By Robert G. Skerrett**

RUSSIA, France, and the United States use a pure nitro-cellulose powder for their naval and military services—in this, being contrary to the practice of the other principal maritime powers. It is said that the nitro-gylcerine powders are more stable and less affected by high temperatures, but they have one serious disadvantage—they erode the gun bores more quickly because of the greater heat of conflagration; the pure nitro-cellulose powders being superior in this particular. Our own people, with reason, claim that our powder is reasonably stable for a period of ten years, and it is recognized that the magazine temperatures should be kept within proper control in order to minimize the tendency to "quicken" due to volatilizing of the remaining percentage of solvent. This is an administrative problem, and our officers recognize it and see to its execution. Such does not seem to have been the case in the French service, no matter whether powder B was chemically at fault or not.

After the disaster aboard the "Iéna" in 1907, the French authorities carried out a series of experiments with B powder at Gâvres. When a cartridge loaded with this propellant was merely ignited at the free forward end, it simply burned; but was detonated when the priming charge of black powder at the rear end was fired. As a natural result of those tests, regulations were issued prohibiting black powder and B powder being stowed together in the same compartment. The magazine temperatures were to be kept below a maximum of 77 deg. Fahr. As a matter of record, the temperatures in the magazines of the "Liberté" rose during the summer time as high as 86 and 93 deg. Fahr.! Powder that had become unserviceable was sent back to the factories and reworked—being then issued for practice purposes only, and with the notice that it should be consumed within *a period of three months*. Not infrequently, reworked B powder remained for a longer time on board the French ships, and on the "Liberté" and some of the other vessels there was some of this powder in 4.7-centimeter cartridges dating back to 1899! Despite the regulations to the contrary, black powder priming charges were not stowed in separate compartments from powder B, and projectiles with charges of black powder were kept in the same compartment with other cartridges loaded with reworked propellant B.

It had a long time been the custom in the French fleet to withdraw unused medium and rapid-fire ammunition from the guns of these denominations, and to take these cartridges back to the magazines. Now it is quite probable that the heat of these weapons due to preceding discharges may have been sufficient to impair the B powder in these unexploded shells, thus initiating decomposition and the subsequent development of spontaneous combustion. The high magazine temperatures already recorded on the ill-fated "Liberté" and the nearness of charges of black powder give a reasonably credible explanation of the prime cause of her loss, while the restowage of medium and rapid-fire shell that had been subjected to heat in previously fired guns would give another cause for the initial explosions which led up to the dreadful consummation of that ship's destruction.

We are told that between the first explosions and the final blowing up of the vessel an interval of from 18 to 19 minutes elapsed. The combustion of the gases developed by powder B in a closed compartment was found, by tests at Gâvres, to send the temperature rapidly upward to an astonishing degree. Likewise it was discovered that a period of 18 to 19 minutes would be enough to heat projectiles in this manner sufficiently to cause them to detonate through the inflaming of their priming charges of black powder or their entire charges of black powder, as the case might be.

Immediately after the explosion aboard the "Iéna" in 1907, the German authorities complimented themselves upon their foresight in providing means for cooling or keeping cool their magazines, even though their nitro-glycerine powder is less sensitive to higher temperatures. Admitting that pure nitro-cellulose powder is more sensitive to heat, then we have all the more reason to bear this fact in mind and see to it that our magazines are properly safeguarded in this direction. It is one sane and practicable precaution which can be taken at a moderate outlay compared with the cost and the consequences of either neglect or imperfect provision in this particular. There is no doubt that this has been carefully done in the cases of our more recent designs, but there probably are some ships in the service that fail to measure up to the most modern standard of battleship practice, so far as the cooling of the magazines is concerned.

## The New Element "Niton"

**By Dr. Leonard Keene Hirshberg, A.B., M.D. (Johns Hopkins)**

UNTIL Sir William Osler came along with scathing nihilistic words, and rid the scientific world of the delusion that the waters of lithia springs, sulphur springs, Vichy springs, Carlsbad and other watering places, had the marvelous power of curing joint troubles, blood and constitutional diseases, there was hardly a physician in the civilized world who was not convinced of the therapeutic powers of the particular waters of some particular springs, to which he sent his patients.

Osler and his school soon convinced at least the leaders of the medical profession that the virtues attributed to the waters of any particular health resort were actually caused by the change of scene, open air, graduated exercise, systematic feeding, and distraction from the routine of one's life.

But in 1898 along came M. and Mme. Curie and discovered radium, and then appeared those other giants of physical chemistry, Stone, Freeman, Lorentz, Thomson, Lord Rayleigh, Ramsay, Crookes, Rutherford, Soddy, and Whytlaw-Gray, who discovered, not only the marvelous properties of radium, but also found traces of it in the waters of many resorts.

Sir William Ramsay has just announced not only the discovery and the atomic weight of a new element, "niton," the so-called "radium emanation" of Rutherford and Soddy, which results from decomposition of radium, but he has also proved that the curative value of the spring at Bath, England, is due to the "niton" contained in its waters.

The proof that each atom of radium yields an atom of the gas helium was settled for all time by Sir William Crookes and Prof. Rutherford. They covered a screen with crystals of sulphate of zinc. As the miniature explosions take place during the escape of helium from radium, the helium is shot out with much force; as the atoms strike the screen, flashes of light appear. These, of course, are the alpha rays, so called.

After these particles of helium have broken away, the atom of radium is really radium no longer, but a gas which is now known as the new element "niton." The rate of change of radium into "niton" progresses in a slow, geometrical disintegration. After a period of 1,760 years, one ounce of radium will have changed into half an ounce of niton and helium, while one-half an ounce of unchanged radium will remain. Allowing another 1,760 years to elapse, and one-half of the half ounce or a quarter of an ounce of radium will be changed to niton and helium. The other quarter will remain as radium. The next 1,760 years would make an eighth of an ounce change and an eighth of an ounce remain unchanged. Thus this curious half period of decay will go on indefinitely.

Niton, like helium and argon, is practically inert. It forms no chemical salts or other compound, and its existence is temporary, lasting a little less than four days. To be exact, after 3.86 days it in turn disappears, and changes over into something new.

Sir William Ramsay proved that 75 per cent of the wonderful powers of radium is due to niton. He has also shown that like most other gases, niton is compressible and can be converted at room temperatures into a liquid by a simple compression.

Pressed into a silica glass tube of very fine bore, it will become solidified into a microscopical stick of ice-like material. Though it cannot be seen, it causes a light in the tiny glass tube as brilliant as an arc lamp.

Liquid niton also causes a faint violet incandescence. In the dark it is most beautiful. The liquid itself, however, in a lighted room appears quite clear. Ramsay and his assistant, Whytlaw-Gray, found that the atomic weight of niton is equal to that of an atom of radium minus an atom of helium. Since radium is 228 and helium 4, niton has the atomic weight of 224. Like radium, niton decays in that curious geometrical ratio called "half period of decay." Thus, niton changes one-half in four days, in eight days a quarter of it is left, in twelve days an eighth, sixteen days a sixteenth, twenty days a thirty-second, twenty-four days a sixty-fourth, so that practically at the end of one month it has all changed.

The products of this decay of niton are at the present moment being investigated by Prof. Rutherford. Since they are all solids, it is quite possible that to our present list of 85 elements, a number of others will soon be added. For the time being, he calls them radium A, radium B, radium C, radium D, radium E, radium F, radium G, radium H, radium I. They have so far eluded Prof. Rutherford, because they decay so rapidly. Like radium itself, each one of these final elements (if they turn out to be elements) shoots out electrons—the beta rays. Thus is the ancient notion about therapeutic waters again established by scientific investigations. The waters analyzed by the followers of Sir William Osler, and found to contain nothing of medicinal nature, are now shown really to contain niton with its powerful spray of tonic electrons.

# Correspondence

*[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]*

## Utilizing Surplus Potatoes

To the Editor of the SCIENTIFIC AMERICAN:

I have read with much interest your editorial in the issue of March 16th regarding "Utilizing the Surplus Potatoes" in Germany. I am a German and worked in this line about five years ago, when I was superintendent of a plant for manufacturing potato flakes.

If it is of any interest for you, I would say that in making potato flakes there is the advantage that the product will not spoil or rot. I saw at the time mentioned, flakes which were about five years old and yet they were just as good as if they were manufactured the day before.

Of course, it is necessary to make the flakes entirely dry to keep them in good shape.

Kankakee, Ill. MAX ERDMANN.

## Virginia Roads

To the Editor of the SCIENTIFIC AMERICAN:

During the past five years Virginia has made considerable progress in the improvement of roads.

The State Highway Department and State aid in the form of convict labor were inaugurated in 1906. State money aid in addition to the convict labor was begun in 1909.

Up to the end of the last fiscal year there had been built under the supervision of the State Highway Department about 900 miles of road scattered through seventy of the one hundred counties, and there is in contemplation a considerably larger amount.

Twenty counties in the State have issued bonds for road improvement aggregating $4,000,000. Seven other counties are contemplating bond issues in the near future, the aggregate of which will be $2,000,000 more. Quite a number of counties whose incomes are sufficient to enable them to do so, are building a considerable mileage without the aid of bonds.

The sentiment in favor of good roads is growing rapidly throughout the State, and it is generally thought that the present bad condition will rapidly improve. P. ST. J. WILSON, Commissioner.

Richmond, Va.

## The Beach Tunnel

To the Editor of the SCIENTIFIC AMERICAN:

I distinctly remember as a young man the inception of the Broadway tunnel, as described in your issue, and of having been in the tube, but do not recall any operating phases of the same, nor of seeing any car.

Some years later I also recall that the excavation was utilized for a beer cellar or saloon, the entrance to which I am not positive about, being either from the street, or from some adjoining building or saloon. If the memories of fifty years ago could be called up for an accurate statement of facts relating to this most interesting episode, it would go far to arrive at historical facts pertaining to the same.

Providence, R. I. G. SHEFFIELD.

[The car was not operated until some time after the tunnel was first opened. After the tunnel was abandoned we have no definite information that it was ever utilized as a storage place for beverages of various kinds. It, however, has been used as an outlet for exhaust steam. The entrance was in the sub-cellar under the sidewalk in front of Devlin's clothing store, at the southwest corner of Warren Street and Broadway.—EDITOR.]

## Steering an Aeroplane

To the Editor of the SCIENTIFIC AMERICAN:

As a subscriber to your paper, which I am thoroughly convinced is one of the grandest scientific papers in the world and a great wielder of influence that spells progress, I would refer to the article in the February 10th number of your paper entitled "Difficulties in Steering of Aeroplanes."

The writer speaks of the machine turning in the opposite way to the motion of the propeller. I am of the same opinion of the proposition as W. G. Blush in his article of March 9th. If he means opposite the way the top of the propeller is going, why opposite the top more than the bottom?

Now I have had no experience in the steering of aircraft, but I have had considerable in handling water craft driven by a propeller, and I know this: when the elements are absolutely quiet, rudder neutral, your craft in perfect poise, and your propeller in center of resistance, that no trouble is experienced, such as our friend says exists in the manipulation of aircraft with but one propeller.

I wanted to cite this as what I think an absolute proof to the contrary of the article I have reference to. His propeller must not be in the center of resistance, otherwise a direct course would be pursued.

Santa Ana, Cal. C. S. THATCHER.

## The Rotary Mimeograph Case

To the Editor of the SCIENTIFIC AMERICAN:

From St. Loius *Republic*, March 18th, 1912.

Section 8, Article VIII of the Constitution provides that "Congress shall have power to promote the progress of science and useful arts by conferring for limited times to inventors the exclusive right to their discoveries."

The attention of the Supreme Court's critics should be called to the word "exclusive" in that article, as well as the statement that the object of the patent laws is to promote progress in various lines of trade.

I believe the fundamental principle and object of all patent laws is to benefit the people at large, not merely to make rich a few patentees and owners of patents.

But the patentee is a creator of something that did not exist; no person is deprived of a single right or thing which he previously possessed.

Each of us may pay the patentee's price, and thereby obtain his permission to use the patented article, or we can continue to use the antiquated things like the tallow candle or the pen and ink of our forefathers.

Patents are not eternal monopolies; they become free after seventeen years and after that all may take advantage of them.

No amendment to the patent laws is needed, except in prohibiting unreasonable combinations of owners of patents in violation of the Sherman act.

The patent system has helped to make the United States the greatest manufacturing country in the world, and that inducement to inventors should not be diminished. JOHN C. HIGDON.

St. Louis, Mo.

## The Gregorian Calendar

To the Editor of the SCIENTIFIC AMERICAN:

In the article printed in your issue of March 2nd, "The Heavens in March," I find in the last paragraph on page 204 the statement that we have to put in a leap year every four years to keep the sun and the calendar together. This is so. But inasmuch as the real interval between successive passages of the sun through the equinox is 365 days, 5 hours and 49 minutes, at the end of the four years we only have (5 hours and 49 minutes by 4) 23 hours and 16 minutes, or 44 minutes less than the day we put in. The last year of each century, which for a similar reason than the one above stated should be a leap year, is not such, presumably to correct the difference of 44 minutes. But in the 24 leap years in each century we have put as many times 44 minutes too much, which is equivalent to 1,056 minutes, while the day that we fail to put in on the last year of each century is 1,440 minutes. According to this figuring, at the end of each century we are still short 344 minutes. Is this correct? If so, will you kindly explain how the said difference is dealt with? WILLIAM FALBE.

Mayaguez, Porto Rico.

[Our correspondent's letter is correct as far as it goes. But he seems to forget that on the Gregorian calendar, which is now universally used (except in Russia) a leap year is added at the end of every 400 years, so that the years 1600, 2000, etc., are leap years, although 1700, 1800, 1900, etc., are not. The Julian calendar, in which every fourth year is a leap year, does run ahead of the true reckoning by 44 minutes every four years (more exactly, by 44 minutes 57.96 seconds) which makes a total in 400 years of 4,496 minutes 36 seconds. But on the Gregorian reckoning three days, or 4,320 minutes, are dropped out, leaving an error of only 2 hours 56 minutes at the end of the 400 years. This amounts to one day in a little over 3,200 years—which for practical purposes is close enough.—EDITOR.]

## Merchant Marine a National Issue

To the Editor of the SCIENTIFIC AMERICAN:

It is indeed encouraging to note from an editorial in your issue of March 9th, "Merchant Marine a National Issue," that so many of your readers have been manifesting an interest in the subject.

In spite of the popular hostility to the term "subsidy," it is evident that sentiment favoring the extension of government aid to our almost moribund ocean marine has been steadily growing during the past two or three years, receiving fresh stimulus from the approaching completion of the Panama canal and rumors of German commercial activity within striking distance of the canal zone.

This sentiment among thoughtful citizens of this country will, we trust, continue to develop at a rate commensurate with that increased knowledge of the subject to which the SCIENTIFIC AMERICAN during the past twelve months has so largely contributed. In view of the facts, as you say, the apathy of Congress, to say the least, seems bewildering.

A mail subsidy or an ocean mail bill providing increased compensation for steamship lines carrying the United States mail (South American lines especially) would, no doubt, be far less distasteful to the American people than a direct ship subsidy bill; although the latter would not be open to such serious objections as any system of discriminatory duties, which by provoking retaliation from other nations would cause our ships to lose as much as they would gain. Although it is very true, as has been said, that retaliation is a game at which two can play, it is at the same time a game which results in detriment to both and to the benefit of neither of the participants.

It should be the policy of our government to encourage our own shipping rather than to injure that of other countries.

It may hardly be necessary to observe, in conclusion, that any measure, by whatever name it may be called, which gives substantial government aid to our deep-sea commerce, must encounter the animadversion of all the demagogues from Maine to California. It must also meet the fierce opposition of a school of optimistic statesmen, who invest with the tints of the rainbow those delusive visions of phantom ships to be built in the clouds with preferential duties and "without a cent of subsidy."

We give ample protection to our industries upon the land as well as to our coastwise and domestic shipping. Why should not our deep-sea vessels be made the recipients of the same protective policy? Why should we pursue toward them alone that niggardly policy which has almost swept the Stars and Stripes from the high seas and from every foreign seaport of the world? JAMES G. MCBRIDE.

Canton, Miss.

## Mr. Jerwan Replies to a Critic

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of March 16th, 1912, I read an article on "Gyroscopic Action in Aeroplanes," by Joseph A. Blondin, in reply to an article under my name published in your issue of February 10th, 1912.

Taking the machine in question (a monoplane in which the propeller revolves anti-clockwise as viewed from the front) it can be easily noticed that in starting, when the motor reaches the necessary velocity and the machine is let go by those holding onto its tail, the pilot gives one, two or three quick and sharp kicks to the foot bar which operates the vertical rudder, with his right foot, so as to prevent the monoplane from turning to the left. If the operator fails to do that and the machine takes its course in turning to the left, it cannot be righted up at all, but keeps on turning round and round until the power is stopped; and such have been the experiences of beginners. Once a runaway Blériot monoplane with its rudder set straight circled round and round on the ground in the direction opposite to that of the revolving propeller for about twenty minutes until at last it broke down. If Mr. Blondin will try to run a monoplane with the belief that it tends to deviate in the same direction as the rotating propeller, he will experience unpleasant results which will make him understand how valuable (?) "Vehicles of the Air" will have been to him as well as it has been to others.

In his article Mr. Blondin gives a wrong explanation of my statement as to the effect of the gyroscopic force on either turn. The statement was that the head of the machine points upward on a right turn and downward on a left turn, and not that the machine rises and dips on these turns. For a better explanation I will give the following: Considering the elevator to be set in the same position without changing its angle of incidence and without banking the machine on either turn, in a right turn the head points upward and in a left turn the head points downward. But if the elevator is operated so as to level up the machine longitudinally, as it is often done instinctively and unconsciously by pilots, the machine then rises on a left turn and descends on a right turn. In making series of figure eights, the foregoing facts could be readily observed even by spectators.

In conclusion, it is not amiss to impress upon Mr. Blondin's mind the fact that mere theorizing and didactic generalization do not play any important part in the birth and development of practical sciences. As an instance, I would call his attention to the remark attributed to the late Prof. Simon Newcomb, who, after years of study and mathematical calculations pertaining to mechanical flight, gave as his opinion the impossibility of man's conquest of the air with a heavier-than-air machine, which opinion, with all due respect to the memory of that illustrious savant, has been exploded by successful flights of machines brought forth by dint of observation and experiences upon which didactic authors would do well to base their academic statements.

New York city. S. S. JERWAN.

# Girdling the Globe by Wireless

## The Navy Chain of Wireless Stations

By Dudley Harmon

THE United States Navy Department is now planning the construction of a chain of wireless stations more extensive than any similar system in existence, or contemplated by any other nation.

Two oceans and a continent will be embraced within the range of this chain. Naval vessels, whether near the African coast or in Chinese waters, will be under direct control from Washington by aerial communication. An appropriation of one million dollars is wanted to complete the project already begun.

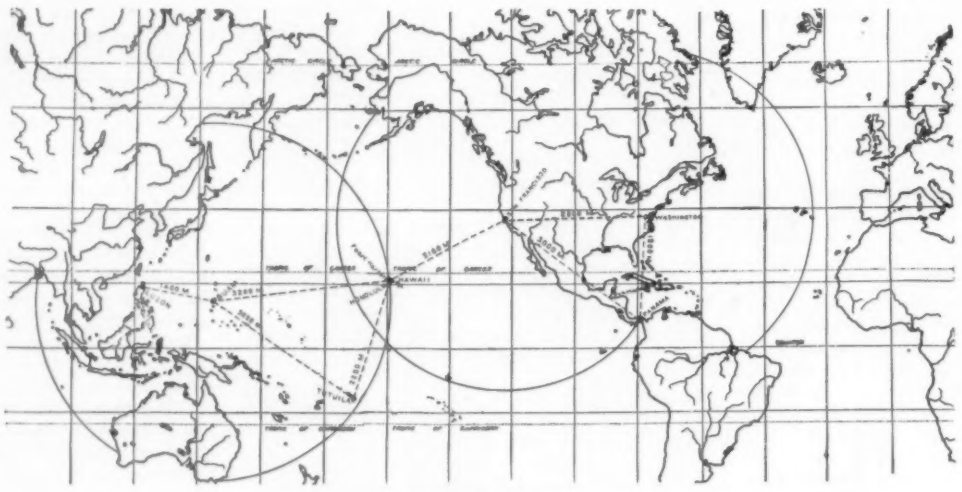
The first station is now in course of erection at Arlington, Va., across the Potomac from Washington. The other stations will be built at the Panama canal zone; San Francisco, Cal.; Pearl Harbor, Hawaii; Tutuila Island, in the Samoas; Guam: and Luzon, Philippine Islands.

Each of these stations is to have a sending radius of at least 3,000 miles. Rear Admiral Hutch I. Cone, chief of the Bureau of Steam Engineering, expects the sending radius will prove to be considerably more, but he insists on conservatism in making predictions. At even the minimum estimate of Admiral Cone, however, each station will be able to exchange messages with the next adjoining station, thus completing the chain of transmission between East and West.

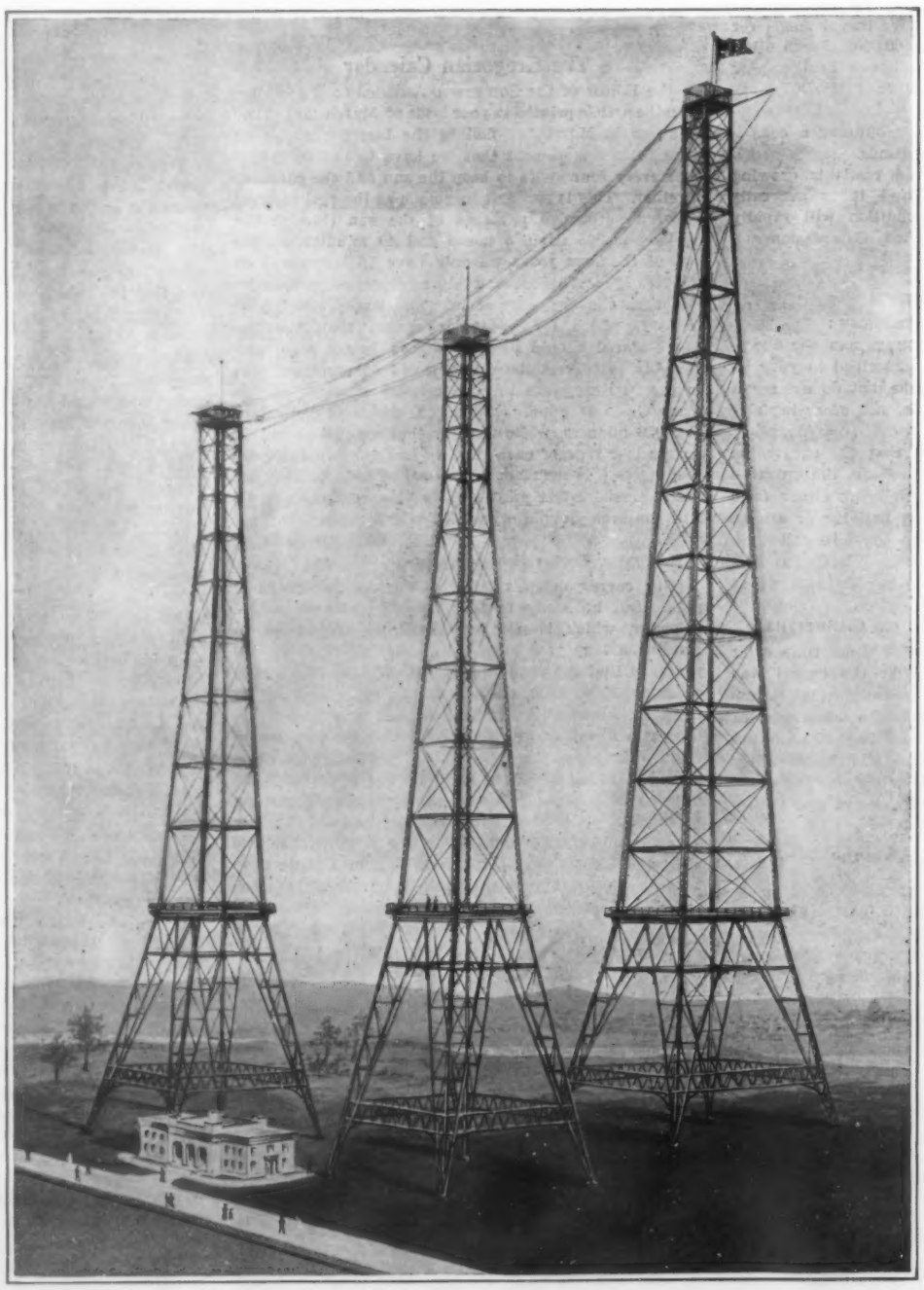
The design adopted for the Arlington station will be followed in the construction of the others. The Arlington station, now building, consists of three steel towers, arranged in the form of an isosceles triangle. At the apex of the triangle is a tower 650 feet high—95 feet higher than the tip of the Washington Monument. At the base are two towers, each 450 feet in height. The antenna are to be strung from the tallest tower to the other two. This arrangement gives the maximum spread, and takes the fullest advantage of the height of the tallest tower. Only the limitations of an appropriation deterred the Navy Department from making all three towers 650 feet high. The towers of the other stations will soon be at least 450 feet in height, and higher if enough money is forthcoming to pay the added expense. One hundred kilowatt wireless sets will be installed in each station.

The height of the towers promises to make these naval wireless stations striking and distinctive features of the landscape at each point where one is erected. Already the towers of the station at Arlington are visible from the streets of Washington, rising far above the outline of the Virginia hills, opposite the capital.

The points selected as sites for these giant stations are already centers of naval activity or strategically important in the operations of the fleet. At most of them there are already small wireless stations in operation, which have come into constant use with the development of wireless telegraphy by the navy.



The navy's wireless zones.



The three aerials at Arlington.

The station at Washington was decided upon first. As the seat of naval authority, from which the movements of all naval vessels are directed, it is the logical place for the location of the most powerful means of communication with the fleet which can be devised. The military reservation at Fort Myer offered a convenient site for the station, and the telephone will bring it as close to the Navy Department, in effect, as if the towers were being erected on the roof of the department building itself.

As is shown on the map, the range of the Arlington station will cover practically the entire North Atlantic Ocean, the principal scene of operations of the battleship fleet. The naval base at Guantanamo, Cuba, falls easily within the range of this station, and regular communication with the big station to be erected at Panama will be had with equal facility. San Francisco, on the other side of the continent, will also be within range, facilitating communication with the ships in the Pacific. At present orders to the fleet in the Atlantic have to be relayed through Norfolk or Key West stations, while the commercial land wires must be used to San Francisco.

The importance of bringing the canal zone into instantaneous communication with Washington is obvious, with the approaching completion of the Panama canal. The canal zone is destined to become the scene of naval, military and commercial activity, and of the highest importance as a strategic possession of the United States. The Panama station will have direct communication with San Francisco, and will afford an excellent means for directing operations in South and Central American waters.

San Francisco, with its great port, and the Mare Island navy yard, is the logical location for a wireless station covering the Pacific Coast. The San Francisco operator will be able to talk with Washington, Panama and Hawaii, besides the numerous small stations in Alaska. Having direct communication with Washington, this station will be of the highest importance for relaying messages between the Far East and the capital.

(Continued on page 369.)

# The Automobile Sanitary Apparatus of Paris

## Modern Methods of Street Cleaning in the French Capital

By the Paris Correspondent of the SCIENTIFIC AMERICAN

INDUBITABLY one of the most necessary and most costly branches of municipal works of any large city is the road plant for watering and sweeping, and it was therefore to be expected that with the advent of the internal combustion motor, experiments would be carried out with a view to substituting the slow and cumbersome horse-propelled watering-carts and sweepers by up-to-date and time-saving automobile apparatus.

Perhaps no metropolis has gone to such a length to bring these machines to a state of practicability and perfection as Paris. Experiments have been going on for the last decade in this city, which have resulted in the adoption of several types by municipalities of many other large towns of France. So great is the success with which the change has met, in Paris itself, that the authorities are indeed contemplating the entire abandonment of the horse-driven plant for street cleaning by automobile machines. Were it not that the cost of upkeep of the machines is extremely heavy, this would have been an accomplished fact long ago.

There are several factors of importance, however, which have to be considered before a definite change can be brought about. It can be understood, for instance, that in thoroughfares in which a large amount of traffic circulates during the greater part of the day, such as on the Grands Boulevards, the Faubourg Montmartre, etc., it is impossible to use an automobile sweeper or waterer to its best advantage. For such work, it seems likely that the animal-driven vehicle will be retained. This is also naturally applicable to the smaller streets in populated districts.

On the other hand, in wide avenues, such as those which traverse the best residential quarters, the parks, and the Bois de Boulogne in particular, the motor-driven apparatus has given exceedingly good results, and the statistics thereon fully show that a saving can be effected by their employment. It must be taken into consideration also that the proposed change would mean an immediate outlay of several millions of francs; and although the Paris authorities are confident of the future of the motor sanitary appliances for street use, they cannot carry out a radical change of the plant until a sinking fund has been established and prospective improvements and simplification of the machinery and a resulting reduced cost of maintenance has been effected. The Department of Public Works considers that the change could be made without much financial sacrifice.

The experiments carried out in Paris for watering and sweeping by motor-driven machines have resulted in the recent adoption of the following types, which may be divided into three categories:

1. Machines used exclusively for watering.
2. Combined machines for watering and sweeping at one and the same time or separately.
3. Machines used exclusively for sweeping.

In category No. 1 two types have now been in use for the past few years and have given entire satisfaction. The first to be put in circulation was a steam watering cart that consisted of a rectangular tank of 5,000 liters capacity, mounted on a steam lorry. A centrifugal pump of the Farcot system forces the water under pressure into the distributor boxes, with a variable outflow placed at the back of the vehicle.

The chassis is built up of steel plate girders with ash beams and cross-braced with section steel, while the propulsive organs are composed of a multi-tubular steam boiler and two annular steam chests supplying power to the engine.

The centrifugal pump which makes 750 revolutions a minute when the lorry is running at 9 kilometers an hour has a delivery capacity of 2,000 liters per minute; while the pressure, which can be varied from zero to 2.5 kilogrammes, allows for watering over a width of 2 to 16 meters of roadway. A single driver can work the apparatus, and it is specially designed for watering wide avenues.

The second type, which has recently been accepted, is a water cart with a Mors gasoline motor, and it is built up on similar lines to the combined sweeper and waterer further described. The tank has a capacity of 3,100 liters, and the outflow is obtained by two delivery boxes placed in front of the vehicle. The Mors motor is of the standard four-cylinder 28 horse-power model, and the whole machine weighs when full 6,895 kilogrammes.

A new and improved automobile water cart is also in use at Versailles, constructed by Messrs. De Dion-Bouton, with an 18 horse-power motor, while the tanks will hold 3,200 liters.

In comparison it may be stated that a steam or gasoline watering cart does the work of approximatively four animal-driven machines; and while the working day of the former has been calculated to cost 48 francs 70 centimes, the latter doing an equal quantity of work costs 56 francs 50 centimes, thus showing a saving of 7 francs 80 centimes per day.

Among the combined machines which fulfill the conditions of the second category, one type is now being used exclusively, and it was the result of a series of trials carried out by the municipality of Paris with an ordinary horse sweeping machine attached to the steam watering cart already referred to.

It is constructed by Messrs. De Dion-Bouton et Cie., and the first of its kind was put in service as early as 1907. The present model is fitted with a motor of 24 horse-power, four-cylinder, which has been found much more satisfactory than the 15 to 18 horse-power motor used in the previous models.

The tank capacity is of 2,600 liters, and the roller brush is placed between the front and driving wheels at an inclination of 50 degrees to the axis of the vehicle. A Dumont centrifugal pump forces the water through a four-way cock to the two distributing boxes placed in the rear. An interesting feature is the spraying apertures placed in front of the brush to check the dust caused by the latter. In the winter the watering arrangement can be removed, thus reducing the weight and allowing the machine to be used as a sweeper.

It has been noticed that the De Dion motor sweeper and waterer does the work of four sweepers or three one-horse watering carts of 2,000 liters and two of 3,000 liters capacity.

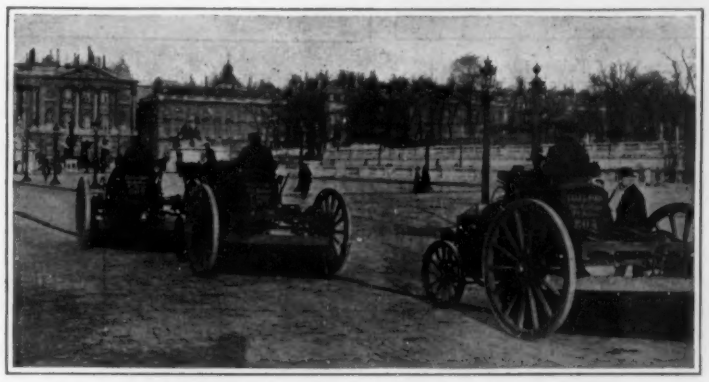
The gross cost per day of 10 hours working of the automobile combined machine has been reckoned to be 82 francs 70 centimes, including the sum allotted for the sinking fund and the maintenance, as compared to a total of 149 francs for the working of the above five horse-driven machines for the same amount of time.

Among the machines for sweeping, only two types need be considered which are to be met on the Paris streets at present. The first, which has been doing service for several years already, but which is constantly being improved upon, can be described simply as an ordinary sweeper of the well-known Sohy system adapted to a gasoline-driven front tractor of the Latil type, which is composed of an Aster two-cylinder 12 horse-power motor and differential working on a Cardan shaft and internal gearing on a crown spur wheel fitted to the wheels of the tractor. This tractor can also be coupled up to a water tank of 1,200 liters capacity, in place of the sweeper, the interchange requiring only fifteen minutes to effect, and this system has been found extremely serviceable.

The other model, which is an automobile sweeper proper, is of the Laffly system and is remarkably compact. A two-cylinder 8 horse-power Renault motor is used, and it has proved sufficiently powerful for this kind of work.

The differential transmits the movement to the back wheels by transverse Cardan shafts and external gearing on a crown spur wheel fixed to the wheels. This apparatus can also carry a tank of 350 liters, and a geared pump drives the water under pressure to the spray holes, which prevents the dust rising.

The greatest innovation of the Paris *service de la voirie* may, however, be reckoned to be the new salutary automobile truck, but the period of experimenting is not yet over. It may be taken for granted that this machine will be a great labor-saving service and a step toward effective sanitation. As may be seen by the accompanying photograph, the truck is composed of the plant and a deep iron box provided with covers which may be opened as shutters, sliding over one another. The emptying process has been simplified to the utmost and consists solely of releasing the iron plates which form the bottom of the truck, when the refuse drops out.

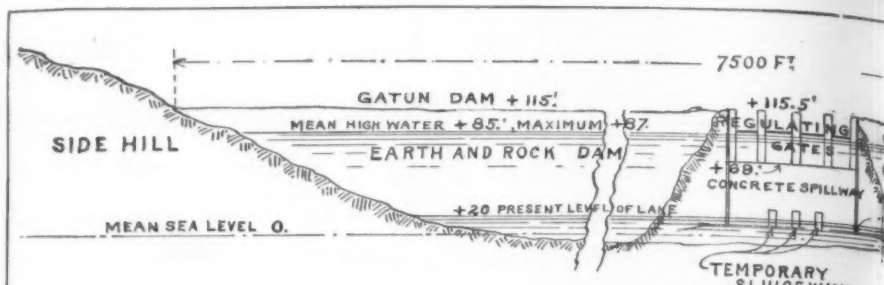


**A team of sweepers in staggered position, so that one picks up the sweepings of the other.**

**New automobile sweepers operated by the Paris municipality on the Place de la Concorde.**

**New sanitary automobile truck used by the Paris municipality for street service.**

Gatun Lake will cover the site of the town of Tabernilla, lately removed, except for the few buildings shown.




To the right are the locks built of concrete in the solid rock on the easterly si'e of the valley. In the center of t River flowed through the spillway. For some months the river has been shut in by the erectio above the valley. To prevent the lake from rising above the lock sills, t

**Cross-section, not to scale, of the Chagres valley**

# Panama—Personal Impressions of the Work on the Canal—I

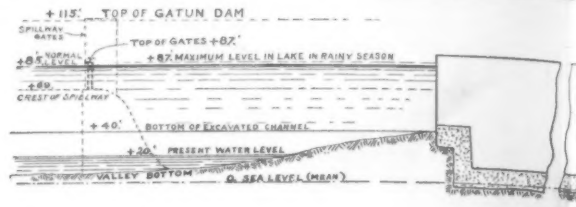
By J. Bernard Walker

*[This is the first of a series of articles on the Panama canal, written by the Editor-in-Chief of the Scientific American. The author was sent to the Isthmus by the Publishers of the Scientific American for the purpose of making a personal inspection of the work and gathering the impressions upon which this series of articles is based.]*

A RECENT visitor to the Panama canal asked the engineer who was showing a party over the work when the sea water would be flowing through the canal. Were conditions other than they are, and had de Lesseps and his French engineers carried out their scheme for a sea-level canal, the question would have been perfectly in place; for, with a difference in level, reaching at times as high as ten feet, between the Atlantic and Pacific oceans, a sea-level canal would not only have been filled with salt water, but there would have been a flow north or south, the direction of the current being determined by the relative state of the tides. But the French failed in their undertaking, and the Americans, thanks to the adoption of the minority report of the Board of Engineers, decided to build a high-level canal. Consequently, out of a total length of 50 miles, only 15 miles of the canal will contain salt water. The other 35 miles will be filled exclusively with fresh water, supplied by the Chagres River and the lesser streams which are intersected by the canal.

The greatest physical difficulty that presented itself to the many able engineers who made the early investigations of the Panama route was the turbulent Chagres River. With a view to reducing the depth of the excavation which would have to be made for a canal, the engineers naturally looked for some valley of very gradual ascent, through which the canal could reach the Culebra Mountains, which traverse the isthmus approximately parallel with the sea. They found such a depression in the valley of the Chagres, which extends from the Atlantic, some 25 miles, to the base of the Culebra divide, and then swings to the left or east, the source of the river lying far back among the hills. From the point, Gamboa, where the river intersects the line of the canal, the natural surface of the ground rises more steeply up the valley of the Obispo until the summit is reached, at an elevation of 320 feet above sea level. On the other side of this summit, about seven miles from Gamboa, the engineers found another valley, that of the Rio Grande, which provided a natural outlet to the sea.

But although the valley of the Chagres greatly reduced the work of excavation necessary over some 25 miles of the canal, the river itself, because of the torrential floods to which it is subjected in the rainy season, presented a problem of appalling magnitude. The rain in this district has been known to show a fall of 5.86 inches in one hour, and at Gamboa, where the Chagres intersects the canal, the river has risen as much as 25.6 feet in 24 hours, the discharge at the commencement of the flood being 8,200 cubic feet per second, and 24 hours later, at the height of the flood, as high as 90,000 cubic feet per second. Furthermore, between Gamboa and Gatun the Chagres receives twenty-six tributary streams, all of which, like the larger river, are torrential in character and subject to


+115' TOP OF GATUN DAM
SPILLWAY GATES
TOP OF GATES +87'
NORMAL LEVEL +85'
+87' MAXIMUM LEVEL IN LAKE IN RAINY SEASON
+89' CREST OF SPILLWAY
+40' BOTTOM OF EXCAVATED CHANNEL
+20' PRESENT WATER LEVEL
VALLEY BOTTOM
0. SEA LEVEL (MEAN)

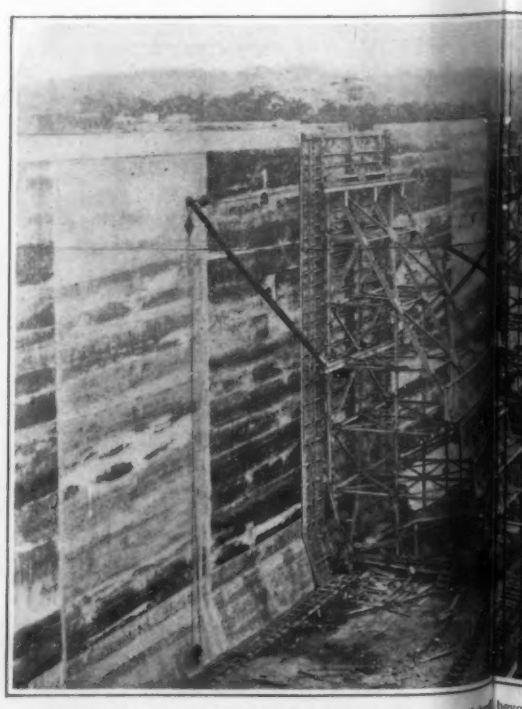
Ships will be raised in three flights from Atlantic sea level to Gatun Lake lev will be raised to 87 feet. Loss through lockages, evaporation

**Diagram, not to scale, show**

**Shaded portion shows present area of Gatun Lake at 20-foot level.**

This view shows the spillway, with the partially filled Gatun Lake beyond. To the left is a completed portion of the spillway dam, with its crest 60 feet above sea level. The rock dump beyond is a portion of the Gatun dam.

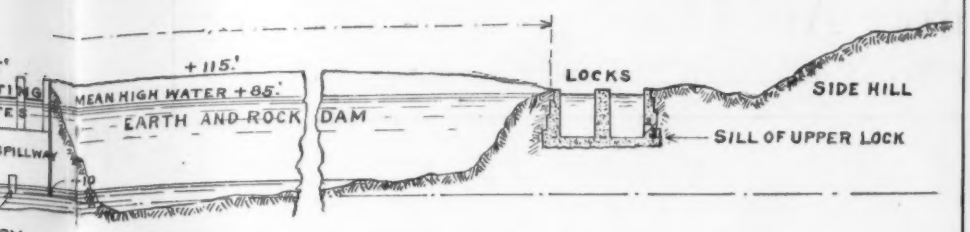
**Present condition of Gatun dam spillway.**



Floor of this lock is 41 feet below level of water in sea-level ch beyo which will be blasted ou the

**Looking seaward thro lower**

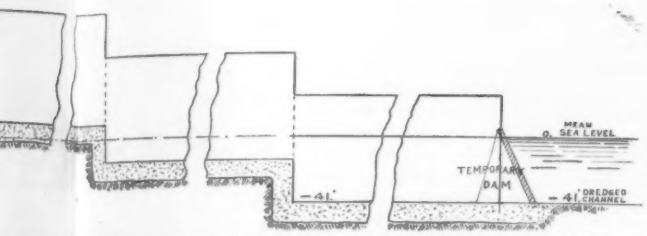
Photograph is




he center of the dam is the spillway, with a channel 300 feet wide. During the earlier construction of the dam, the Chagres by the erection of the spillway dam, and the Gatun Lake is slowly forming, its level being to-day 20 feet he lock sills, the water will be regulated by temporary sluiceways in the spillway dam.

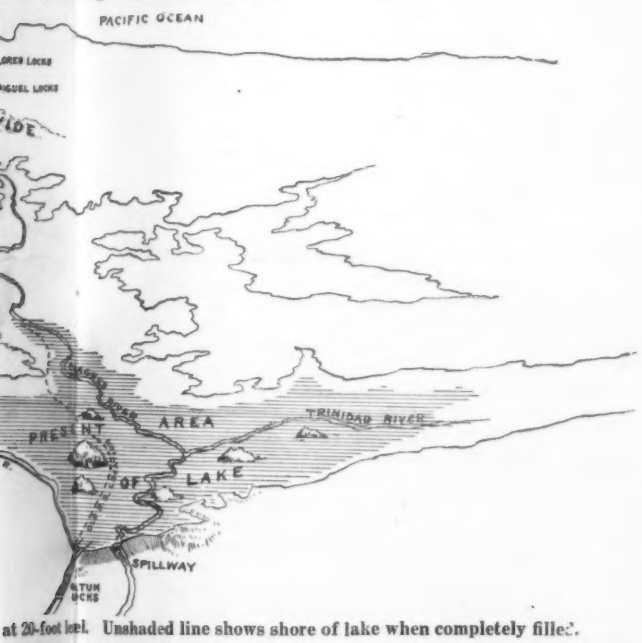
**agres valley at Gatun, showing the locks, dam, and spillway.**

**Looking seaward from Colon, the Atlantic terminus of the canal. Note the foundations for the new Washington Hotel.**




Gatun Lake level, which normally will stand at 85 feet. During the rainy season the level ges, evaporation, etc., will reduce this level a few feet during the dry season.

**o scale, showing Gatun locks and lake.**




at 20-foot level. Unshaded line shows shore of lake when completely filled.

# Controlling the Chagres River by the Gatun Dam and Spillway

*"An English scientist, who at first was skeptical as to the Gatun dam, said, after a recent visit, that he was converted to the present plan, because it is not a dam at all that is building, but a veritable hill."*
*Col. Geo. Wm. Goethals in The National Geographic Magazine.*

sudden and extremely violent floods. Had the canal been built at sea level, the Chagres and its tributaries would have required costly diversion channels to carry the water to the sea independently of the canal, and these would always have constituted a more or less serious menace.

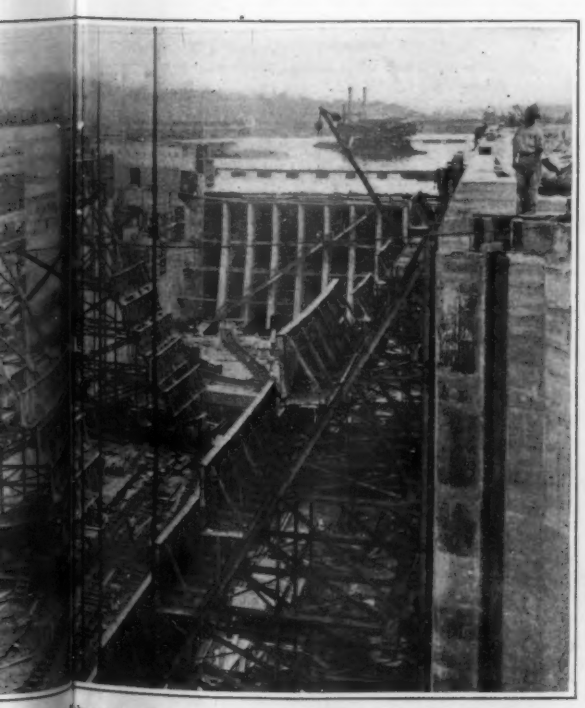
Incidentally, it may be mentioned here that the excavation through the mountain divide has shown the material of which the hills are composed to be of an extremely unstable character; so much so that fifteen million cubic yards of slides have already been removed and there is a large amount yet to come. It is certain that if the cut through the whole length of the Gatun Lake had been carried 85 feet lower in the endeavor to open a waterway at sea level, the slides would have developed such enormous proportions as to delay the construction of the canal by a number of years, and increase the cost probably by several hundred millions of dollars.

Now, it so happens that, about six miles from the mouth of the Chagres River, the valley, at Gatun, narrows down to a width of less than a mile and a half. On the eastern side of the valley, at the surface, is rock of a fair quality. At about the center of the valley the engineers found a small hill of similar rock, and they determined to improve the natural opportunities thus presented by throwing a great dam across the valley, cutting off the outlet of the Chagres, and causing its waters to accumulate in a vast lake, which would back up through the Chagres valley and extend the whole length of the great cut through the mountain divide. The rock formation on the eastern end of the dam provided an admirable foundation for a system of locks, through which shipping could be raised from sea level to lake level, and the small hill in the center of the valley offered an equally good foundation for excavating and building a spillway 300 feet wide, through which the surplus waters of the Chagres and the lake could be allowed to pass on their way to the Atlantic Ocean.

And so it has come about that the great problem of the Panama canal has been solved by turning an implacable enemy into a useful friend. The torrential Chagres River, ever ready at a few hours' notice to disgorge its enormous, silt-laden floods upon the canal, has not only been taken into the general scheme of construction, but has been constituted its most important and absolutely indispensable element.

The lock-and-lake canal, as now being built, provides a channel from ocean to ocean which is nowhere less than 40 feet deep and whose width is at no point less than 300 feet on the bottom. Even through the locks this waterway has the generous width of 110 feet. Starting from deep water on the Atlantic Ocean, the canal extends for seven miles at sea level to the great

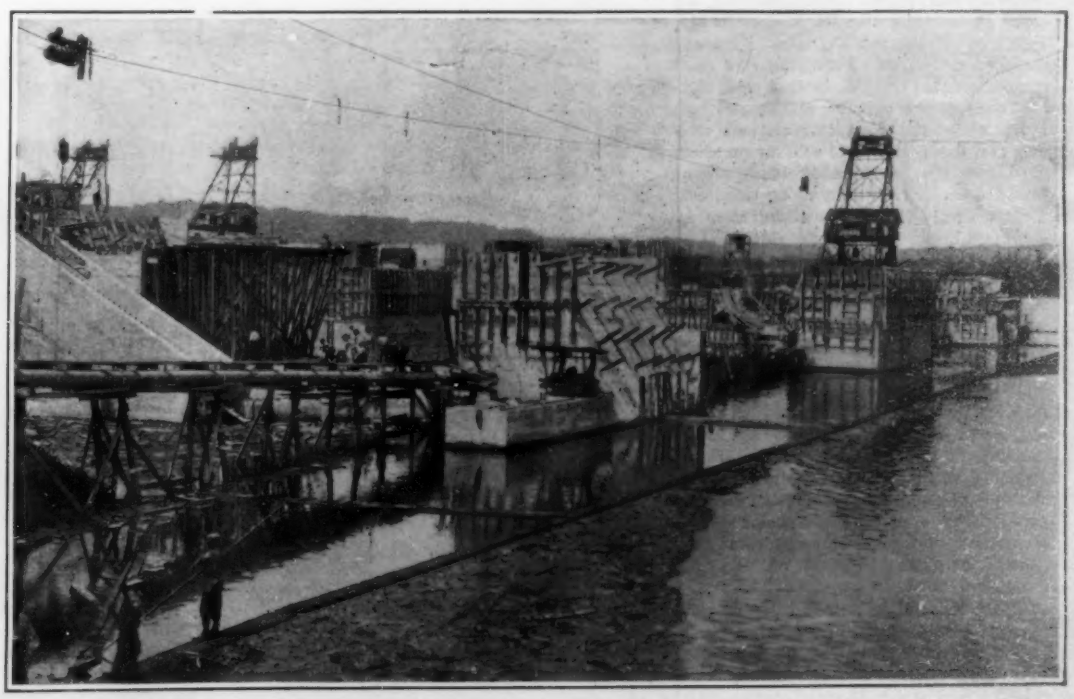
*(Concluded on page 370.)*



sea-level channel beyond. Note the temporary concrete dam across the entrance, blasted out when the canal is ready for service.

**ard through lower end of Gatun locks.**

Photographs by Underwood & Underwood



**The channel from the Atlantic to Gatun, seven miles long, is at sea level. Note the sloping face of the two dams, 45 feet high, which keep the water out of the locks during construction.**

**The sea-level entrance to Gatun locks.**

# What Inventors Are Doing

## Simple Patent Law; Patent Office News; Inventions New and Interesting

### The Herring-bone Spiral Turbine

ANNOUNCEMENT was recently made that a steam turbine had been invented which consisted essentially of two spiral gears in mesh with each other. Steam admitted between these gears acted both by impact and expansion to revolve them in opposite directions. At first one might suppose that this engine belonged to a freak class; but it seems that the device has been under rigid test for a number of years and is now being put on the market by a company of established reputation.

Five horse-power turbine and the inventor.

The operation of the engine, though very simple, is rather difficult to illustrate. The rotors as shown in Fig. 1 consist of two herring-bone spiral gears in mesh with each other; it will be observed that at the middle of the line of contact of these two gears ,there is a V-shaped pocket which is completely inclosed when the gears are placed in their casing as shown in Figs. 2 and 4. As the gears rotate in opposite directions, the pockets or channels between the teeth lengthen out until, eventually, they reach from end to end of the gears.

Possibly the action may be understood better by referring to the diagram Fig. 3 in which a single channel is considered. This channel between the spiral teeth of the gear may be called a cylinder of our engine, whereas the pistons that close the two ends of the cylinder are formed by the teeth of the opposite gear. As the gears revolve their line of contact remains fixed, but the intermeshing teeth move from the center outwardly along this line. Thus we have the curious situation of a double-end cylinder moving at right angles to the direction of travel of the pistons.

The end view (Fig. 2) shows how the steam is introduced between the two gears as near as possible to their line of contact. As the steam enters the spiral grooves laterally, it gives the gears an impulse in the direction of the arrows. As the gears revolve past the inlet port the steam is successively cut off from the grooves, after which its expansion is depended upon to rotate the gears until the ends of the grooves have been carried by the rotation of the gears past the line of contact, when the steam escapes at the ends of the gears and passes out through the exhaust port.

Each herring-bone gear is made of two separate spiral gears of opposite pitch joined in proper register upon the same shaft. These gears are cut on a special machine and the teeth are integral with the body of the rotor. Thus is avoided the complication of the ordinary turbine, in which there is a multiplicity of delicate vanes. By introducing the steam at the bottom of the turbine the weight of the gears is taken off the bearings.

The steam pressure forms a cushion between the intermeshing teeth, so that they do not actually touch and there is no grinding noise. The engine in operation produces a humming noise like that of an electric fan. No packing is necessary, owing to the steam cushioning between the gears and the casing and also because there is but a slight drop of pressure from one steam channel to another.

The accompanying figure shows the inventor of this engine, Mr. J. H. Van Deventer, with one of his 5 horse-power steam turbines. For the past three years a large 185 horse-power motor of this type has been in constant use for driving fans, gas scrubbers, and other apparatus. During this entire period it has never been taken apart and has given no trouble.

An air drill operating on this principle is about to be put on the market. The spiral rotors in this drill will be about an inch in diameter and two or three inches long, yet they will be applied to drive a quarter-inch drill through cast iron at the rate of five inches per minute, which calls for an expenditure of ¾ horse-power.

Power for power, this turbine is smaller than an electric motor. The efficiency of the turbine is astonishing until we consider the rapidity of the steam action. If we take a rotor with 20 spiral teeth or steam chambers and drive it at 2,000 revolutions per minute there will be 40,000 expansions per minute, or 666 expansions per second. In tests of the turbine the following results were obtained:

| | Test 1 | Test 2 |
|---|---|---|
| Boiler pressure, lb. gage | 120.0 | 130.0 |
| Initial pressure, lb. gage | 101.5 | 115.0 |
| Horse-power | 25.3 | 151.0 |
| Speed, r. p. m. | 2,450.0 | 2,710.0 |
| Water per brake horse-power-hour, lb. | 53.2 | 31.8 |

### Old and New Patents on Tungsten Incandescent Lamps

EDISON patented (No. 223,898, a high-resistance filament in an exhausted glass globe) the incandescent lamp, January 27th, 1880, and Maxim, June 11th, 1889, expired. Tungsten is and has for years been an important factor in the development of the incandescent lamp industry, especially in the feature of economy of consumption. In a paper delivered before the Technology Congress in the spring of 1911 it was stated, "On the assumption that the present rate of lamp consumption is equivalent to about eighty million 25-watt tungsten lamps per year, and on the basis of 1.25 watts per candle-power as against 3.1 of the earlier lamps and of charging power at 10 cents per kilowatt hour, we get a saving of $240,000,000 per year. Naturally, this is a saving which is distributed among producers and consumers, but illustrates very well the possibilities."

The value of the patent control of tungsten as a lamp filament has been appreciated for years and has been the basis of the well-known Heany case recently decided by Assistant Commissioner Billings. Patent has now been issued (No. 1,018,502) to the General Electric Company as assignee of Just and Hanaman of Budapest, Austria-Hungary, for an incandescent light filament of tungsten in a coherent metallic state and homogeneous throughout. The application for patent was filed July 6th, 1905. Attention naturally turns in this connection to the patent to Von Welsbach (No. 976,-527), which is thought to dominate the metallic filament art, and the relation to and effect of this Welsbach patent upon the tungsten filament production will be watched with great interest.

Apart from the tremendous importance of tungsten in connection with lamp filaments, its value for hardening steel is such that its utilization in the production of tungsten steel tools is said to have worked a revolution in metal cutting lathes, it being estimated that a lathe provided with such tools can be made to cut four times as fast as one having tools of carbon steel.

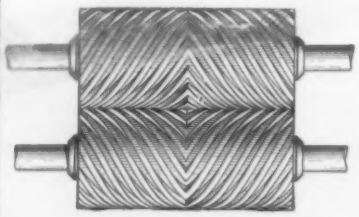


Fig. 1.—The herring-bone spiral gear rotors.

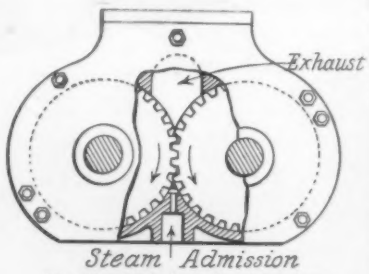



Fig. 2.—End view showing steam inlet.

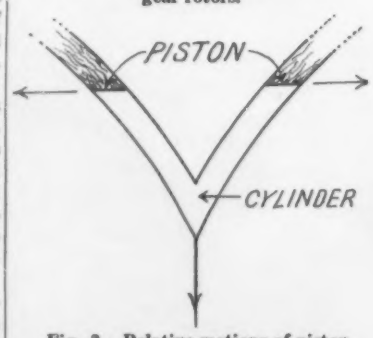



Fig. 3.—Relative motions of piston and cylinder.

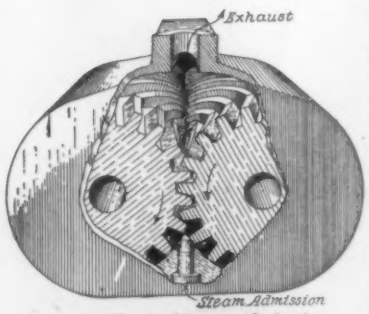



Fig. 4.—The turbine partly broken away.

### Hydraulic Cartridge for Mining

THE dangerous character of many coal mines in Great Britain, where the use of explosives is attended with the gravest risk, has resulted in the hydraulic cartridge coming into extensive vogue. Its application has met with favor inasmuch as it has been found that coal blasted by this means is not so shattered while the percentage of dust is reduced. The apparatus is very simple both in design and operation. It comprises a steel cylinder containing a number of telescopic pistons set at right angles to the longitudinal axis of the cylinder, and projecting in a row from one side. These pistons are joined by means of a pipe to a hand hydraulic pump.

In order to use this system of breaking down the coal it is essential that the latter be undercut. The cartridge hole is drilled to a depth slightly less than that of the undercut parallel to and against the roof. The hole is then cleaned thoroughly with a miner's scraper, and the steel cylinder with the pistons is inserted. There is a small water tank or cup filled with water which is hung on the handle of the pipe and connected with the cylinder. The miner then operates the screw handle, whereby the water is forced along the tube into the cylinder and the pistons are gradually driven outward. As the pressure of the heads of the pistons increases against the head of the coal the latter is cracked, long seams and splits appearing in all directions. The maximum pressure is obtained at the moment the elastic limit of the coal is reached, and shortly afterward it falls in large lumps, the individual sizes of which are seldom too large to be handled by a single miner. The coal is broken gently, there being an entire absence of shock, while there is a freedom from powder and slack. Other advantages are absence of noxious fumes, no damage to the roof, and no danger whatever. The value of the coal brought down in this manner thus is much greater. The cartridge is simple to handle and is much preferred by the miners who have become accustomed thereto, over the conventional means of achieving the same results.

Hydraulic cartridge for mining.

One English colliery has fifteen machines of this class at work in its seams, and although it has been found that the cost of bringing down the coal by hydraulic means is so slightly in excess of the ordinary method as to be beyond consideration, it has been found that its use represents an increased profit of over $370 per day owing to the improved marketable condition of the coal obtained.

The hydraulic cartridge has also been used with conspicuous success in general engineering operations where it is imperative that no shocks should be imparted to surrounding buildings, foundations, etc., such as in docks and harbor works. In such submarine work the cartridges are inserted by divers, the pressure being supplied from pumps on the surface. It has also been used for driving tunnels for sewers under valuable buildings, the excavation of deep trenches for masonry works in the vicinity of existing walls, and so forth, with unique success. When the pistons have accomplished their work the release of the water pressure brings them back to their former position so that the cartridge can be withdrawn easily.

The machine is used in two standard sizes, a 3-inch machine requiring a hole 3½ inches in diameter, and a 4-inch machine requiring a 4½-inch hole, respectively. The latter is the size most generally employed for ordinary work in coal mines. The cost of the apparatus is low, and the maintenance charges nominal, provided ordinary care is observed. A cartridge pumping 30 shots a day in good strong coal has been found to require little repair and to last about three years.

### Old and New Patents on Tungsten Incandescent Lamps

EDISON patented (No. 223,898, a high-resistance filament in an exhausted glass globe) the incandescent lamp, January 27th, 1880, and Maxim, June 11th, 1889, patented (No. 405,170) the process of standardizing filaments by electrically heating them in the pressure of hydrocarbon vapor. Both these patents, while important, have

## The Mattulath Aeroplane Patents

ON January 8th, 1900, Hugo Mattulath, of New York, filed application for patent for a flying machine. At the time of filing application for patent he was in Detroit, Mich., and gave a power of attorney to Barthel & Barthel, patent solicitors of that city. The application was prosecuted by the attorneys in connection with their Washington associate. On March 10th, 1900, objections were made by the Patent Office, the examiner pointing out formal defects and suggesting changes and amendments, and in such action the examiner aid, "The construction is regarded as inoperative for the purpose intended and therefore not useful within the meaning of the patent law. No successful attempt has yet been made to rise from the earth's surface by means of an aerial vessel unprovided with a balloon. The results of previous experimentation indicate that even if the rising could be successfully accomplished, the vessel would be uncontrollable through inability to maintain its normal position or balance. . . . . and the practicability of his apparatus is so problematical that actual demonstration of operativeness will be required before the grant of the patent."

On April 9th, 1900, the Washington solicitor in a communication proposed amendments and argued in favor of general patentability. On May 16th, 1900, the examiner objected to certain claims, allowing one, and suggesting amendments to o hers and in conclusion he added, "The former criticisms as to showing, etc., are repeated." Other amendments were offered during 1901 and 1902, and October 1st, 1902, the examiner in rejecting certain claims, suggesting amendments to other claims and indicating other claims as allowable said "the rejection on the ground of inoperativeness and consequent lack of utility is adhered to."

On September 29th, 1903, the examiner made the following endorsement on the application for amendment, signing his name thereto officially: "This application as amended September 18th, 1903, has been considered. The amendment has been received in this case but no action can be taken upon the merits thereof for the reason that the applicant's death operates as a revocation of the power of attorney to Barthel & Barthel and there is no one of record authorized to prosecute the case." There is no suggestion of the death in the record and it is not shown how the examiner received knowledge thereof. The transcript of the proceedings in the office does not show the fact, but it appears from affidavits filed in the prosecution renewal that a letter was addressed to Barthel & Barthel notifying them of the revocation of their power of attorney by the death of the applicant and it appears in the same way that Mattulath died in Washington, December 30th, 1902. A letter was filed August 14th, 1909, from the Washington solicitor, giving permission to Prof. Zahm to inspect the applications and drawings on file.

On October, 1909, Meta Mattulath received letters of administration on the estate of her husband and executed a power of attorney to R. E. H. Starr of New York, authorizing him to represent her at the Patent Office. This power was accepted by the Patent Office, November 5th, 1909. On September 16th, 1910, she executed power of attorney to Joseph F. O'Brien, which was filed in the Paten Office, and November 22nd, 1910, O'Brien filed a short amendment. The application was entered on the office records as abandoned on October 3rd, 1903. On November 23rd, 1910, the w dow filed petition to revive, alleging that, while she and other members of the family knew that he had worked on a flying machine invention, none of them had knowledge of the existence of the application until about October 13th, 1909, when informed by an attorney in New York who called to request her to sign an instrument authorizing his access to the file. Such authority was given to Mr. Newell, but subsequently she executed a power to Starr and revoked the former. The intestate left no estate. The pet tioner was destitute, and Starr consented to act without a fee if she could advance money for necessary disbursements. She paid him $41 for the purpose, and he agreed to apply to revive the application and she believed the application had been made. She has since learned that no application was made because of the illness of Mr. Starr, which finally resulted in his death. Shortly before his death she wrote him to return her papers in case his illness was so serious he could not prosecute the business promptly. Receiving word that he was unable to proceed, she undertook to recover her papers, including copies of Patent Office proceedings. These papers were scattered and could not be obtained.

The petitioner than undertook to procure the services of others. After some delay she secured the services of Mr. O'Brien who agreed to represent her without compensation. It is claimed that she was never notified by Barthel & Barthel of the refusal to accept the amendment on the ground that her husband's death had revoked their authority and that had she been so notified, she certainly would have ratified the attorneys' act and endeavored to prosecute the application. The papers included a letter from Wilbur F. Wright, dated October 14th, 1909. The petition to revive was denied by Assistant Commissioner Tennant.

In concluding the decision the Chief Justice says "The petitioner has not 'slept upon' her rights" and is entitled to the relief which she seeks. Its denial would work a great hardship unjustified by her conduct upon the penniless widow of a deceased inventor of merit who died almost at the point of success, leaving the invention as his only property.

The decision will be reversed.

The letter from Wilbur Wright is as follows:

COLLEGE PARK, MD.,
14th October, 1909.

MISS ALICE MATTULATH,
NEW YORK.

Dear Madam:

I thank you for your very kind letter of 29th September, which I have found it impossible to answer hitherto. I had already arranged a canoe to float the machine in case of coming down, so could not try the raft you were so kind as to suggest and offer, but I very much appreciate the friendly spirit which prompted you.

I knew a little of your father's work through conversation with Prof. Zahm and others, before he had died before my brother and I had really begun our work.

With many thanks and best respects,

Yours truly,
(*Signed*) WILBUR WRIGHT.

## Sensation and Emotion Mechanically Illustrated

SOCRATES SCHOLFIELD of Providence, R. I., has secured a patent, No. 1,019,703, for an appliance for illustrating the relation that exists between the faculties of sensation and emotion in the animal organism. He suggests that in teaching pupils in schools the evidences of mortality that are derived from the data of practical mechanics and biology, it is desirable to illustrate certain of these evidences by means of schematic mechanical appliances. To this end he utilizes an apparatus comprising a stationary upright spindle, a rotary pendulum governor turning on the spindle and having a collar, arms joining a sliding sleeve to the collar and balls carried by the arms with means for turning the collar and a hand operated lever by which the governor balls may be forced from their plane of rotary equilibrium making manifest the resulting resilient sensibility of the governor. The sliding sleeve is employed as the representative of an organ of sense. In the language of the patent "the rotary pendulum governor when employed as a medium for the regulation of the speed of machinery in a factory will constitute a true mechanical representative of the faculty of emotion" since "whenever the speed of the motive engine of a factory is caused to vary at any time from its proper zero rate by the effect of occurring changes in mechanical resistance, the fear of an impending unallowable variation of speed demands an immediate regulating action to check and limit such variation."

## Notes for Inventors

**The "Phossy Jaw" Bill.**—The Senate has passed the so-called "Phossy Jaw" bill, which taxes prohibitively matches in which white or yellow phosphorus is used. If the President signs the bill, which is very likely, a terrible industrial disease will be wiped out.

**Novel Anti-slip for Shoe.**—Loose chains have been patented in connection with horseshoes; but Charles E. Simpson, of Winthrop, Mass., has patented (No. 1,021,166) an athletic shoe in which a non-slipping chain is held taut between separated points on the sole and is so formed as to present a relatively smooth tread while in normal position, but has sharp biting edges which come into action to prevent slipping when transverse thrusts are imparted to the chain in the use of the shoe.

**Removing Wall Paper by a Condensable Vapor.**—All housekeepers know what a mess it makes to remove wall paper by the ordinary wetting down process. A Cleveland man, James H. Foster, has secured a patent (No. 1,021,084) for a wall paper remover which includes a box-like structure open at one side and a packing strip around the edge of its open side. A trough is provided at the bottom of the box and means for admitting condensable vapor to the interior of the box to moisten the paper, so that it can be easily removed.

**An Advertising Eye-winker.**—Henry C. Avery of Holyoke, Mass., has patented (No. 1,020,956) an advertising device in which a card bearing the image of a face has an eye opening, and an eye is spring-supported in rear of the card in such manner that when the card is vibrated, the eye will also be vibrated at the eye opening.

**A Ship Speed Indicator.**—Lewin J. Heathcote of Baltimore, Md., has secured a patent (No. 1,020,980) for an indicator for the speed of ships. A pipe, open at its front end and receiving water at the bow of the boat, communicates with a water receptacle. The water rises and falls in the receptacle in proportion to the speed of the vessel. A float in the receptacle operates a suitable indicator.

**The Beneficent Nature of Patents.**—Have you ever thought that a patent does not and cannot deprive any one of any right or privilege he had prior to the invention covered by the patent? If it should by its terms abridge any previously possessed privilege, it would to just that extent be invalid and ineffective. Therefore, if the patent should not be a benefit in the form of an addition it cannot be a detriment by subtracting anything in the way of a right or privilege previously enjoyed.

**A Problem in Classification.**—It is sometimes difficult to classify applications for patent, as is illustrated by a story told of Examiner Thomson J. Hudson who, after retiring from the Patent Office, published his well-known book on "Psychic Phenomena." An application was filed for a patent for an amulet. "Where shall we classify it?" was asked Hudson. He replied "in Fire Escapes."

**For Removing Foreign Matter From the Eyes.**—A syringe-like cylinder has a nipple at one end and contains a spring actuated piston whose spring acts to force the piston outwardly to suck any foreign matter that may get into the eye through the nipple into the cylinder, an easily released pawl holding the spring compressed and releasing it to operate as described. A patent for the device embodying the described features has been granted to William A. Jones of Sharon, Pa. (No. 1,020,985).

**Fire Extinguisher for Moving Picture Film.**—Harry M. Marvin of Canastota, N. Y., assignor to Biograph Company, New York, has patented (No. 1,021,060) a moving picture apparatus including a fire extinguishing means for the film, comprising a casing which has an open ended passageway of a size to permit the free passage of the film but sufficiently constricted to extinguish the flames of a burning film that enters the passageway.

**An Elihu Thomson Patent.**—Elihu Thomson of Swampscott, Mass., has obtained a patent (No. 1,021,219) for an igniting apparatus for gas engines wherein the discharge is automatically advanced with respect to the engine piston as the speed of the engine increases. The organized apparatus includes in connection with a source of electrical energy and a circuit with a spark plug, a rotating arm and a receiving shoe at a sparking distance from the arm and curved away from the arc of the rotating arm so that it will automatically advance the charge as the engine speed increases.

**A Soap-bubble Hat.**—Alden L. McMurtry of Sound Beach, Conn., has obtained a patent (No. 1,021,323) for an amusement device in which a cup is arranged in a lady's hat and a small gas holder having a valve controlled by the user is connected by a tube with the cup so that bubbles can be blown when desired from the cup and discharged by a shake of the head.

**Fixing Price.**—In the case of Waltham Watch Company v. Keene, 191 F. R., page 855, it was decided that the owner of a patent who makes and sells the patented article may lawfully fix the price at which retail dealers purchasing such articles may resell it, and a purchaser who violates such condition is an infringer of the patent.

**The Importance of Diligence.**—The case of Hawkins v. Ward decided by Assistant Commissioner of Patents, Mr. Billings emphasizes the importance of promptly filing applications for patents. The invention is a block signal system. Hawkins disclosed his invention about May 25th, 1907, and filed application for patent November 29th, 1907. Ward disclosed the invention about June 15th, 1907, and filed application July 22nd, 1907. Neither party actually reduced the invention to practice and Assistant Commissioner Billings held that the only question involved was whether Hawkins, who was the first to conceive the invention, was exercising due diligence in reducing the same to practice just prior to the time Ward entered the field and subsequently thereto. After Hawkins conceived the invention he entered into an investigation to see whether it would infringe any previously granted patent. During this investigation Ward conceived the invention and filed his application, and Assistant Commissioner Billings affirmed the decision of the Board of Examiners-in-Chief in holding that Hawkins was lacking in diligence and priority was awarded to Ward.

**Who Ever Uses an Invention Given to the Public?**—At the present time many patents are being dedicated to the public. It remains to be seen whether the inventions covered by such patents will prove beneficial to mankind or be utilized to any extent. In a work entitled "Creators of Steel" it is said: "Sir Henry Bessemer is a believer in patents; but to his varied experience in the introduction of new inventions another single fact has to be added. 'I do not know,' he says, 'a single instance of an invention having been published and given freely to the world, and being taken up by any manufacturer at all. I have myself proposed to manufacturers many things which I was convinced were of use, but did not feel disposed to manufacture or even to patent. I do not know of one instance in which my suggestions have been tried; but had I patented and spent a sum over a certain invention, and seen no means of recouping myself except by forcing, as it were, some manufacturer to take it up, and I should have gone from one to the other and represented its advantages, and I should have found someone who would have taken it up on the offer of some advantage from me, and who would have seen his capital recouped, by the fact that no other manufacturer could have it quite on the same terms for the next year or two. Then the invention becomes at once introduced, and the public admits its value; and other manufacturers, like a flock of sheep, come in. But the difficulty is to get the first man to move. The first man might say: "Oh, my machinery cost me a great deal of money. I have my regular trade, and this new scheme is sure to be more trouble to me in the first instance; and when everybody asks for it, every other manufacturer will be in a condition to supply it, so it is not worth my while!" I believe inventions which are at first free gifts are apt to come to nothing.'"

## RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

### Pertaining to Apparel.

HAT PIN GUARD.—J. J. VALLIER, 602 Fairmount Avenue, Blue Island, Ill. This device comprises generally an extended body portion having means at one end for holding a suitable ornament, the interior of the body portion being provided with a spring catch adapted to engage the pin between the two points of support carried by the guard whereby the guard may be securely held in position.

### Electrical Devices.

ELECTRIC WASHING MACHINE.—W. D. JONES, care of Rees & Rees, 232 E. 40th Street, Manhattan, New York, N. Y. This machine has electrodes arranged in the tank or vat to insure the passage of the electric current through the washing liquid without danger of it passing from one electrode to the other by way of the walls of the tank, to prevent stray or extraneous matter of the articles to be washed from coming in contact with the electrodes, and to reduce the danger of an operator coming in contact with an electrode to a minimum. Mr. Jones has invented another electric washing machine to facilitate washing of clothes and to insure the setting or fixing of the colors of the cloth materials by passing the electric current in different planes through the washing liquid and by simultaneously starting the rotation of the revoluble cylinder containing the clothes and passing the electric current through the washing liquid.

ELECTRICALLY OPERATED ANIMAL-TRAP.—R. L. BARNHART, Rooms 6-7 Masonic Bldg., Charlerol, Pa. In this patent, the invention has reference to animal traps, the inventor's more particular purpose being the production of a rat trap in which the rat is killed by an electric current and the body of the rat is automatically dropped in a receptacle for this purpose.

### Of Interest to Farmers.

TWINE CUTTER.—J. J. ANDERSON, care of State Bank of Franklin, Franklin, Minn. The purpose here is to provide a new and improved twine cutter for use on a pitchfork or a like agricultural implement to permit of conveniently cutting the twine or band used for binding a sheaf, corn shock or the like. For the purpose use is made of a cutter blade attached to the ferrule of a pitchfork.

### Of General Interest.

AUTOMATIC FEED-BAG.—GEORGE DOUTNEY, 487 Broadway, New York. One of the most tantalizing contrivances that the poor horse has to put up with is the common feed-bag. The first few mouthfuls of feed are readily accessible, but thereafter the animal must toss his head so as to throw the grain that is out of reach into his mouth. This results in enormous waste, due to spilling of the grain out of the bag. Mr. Doutney's invention aims to overcome this defect by a novel construction of feed-bag, in which the feed is stored in pockets at each side and feeds automatically to the bottom of the bag. The

AUTOMATIC FEED BAG.

bag is open at the front and back except for the shallow box at the bottom, thus providing ample breathing space. There is no waste of the grain, for it is fed to the animal as he eats it and the feed is regulated so that he cannot bolt his food. The feed pockets are very readily filled. The tongueless buckles on the strap permit of adjusting the bag snugly to any animal, whether his head be long or short.

DRIPPING FRAME FOR CANDIES.—G. BRAIN, Long Island City, New York, N. Y. This invention is an improved frame for applying chocolate and other coatings to candies and it comprises means for forming a series of pockets in which the bodies of the candies to be coated are placed before the same are dipped, together with means for displacing the candies from the pockets after dipping and coating them, and at the same time impressing upon the coatings a figure of any desired shape.

DEMONSTRATING CAMERA.—H. LA F. FINSEL, Milledgeville, Ill. The invention relates to optics, the special design being to provide a demonstrating camera which will enable the optometrist, oculist or other operator to explain, demonstrate, or illustrate, for persons whose eyes have been tested, the nature, kind and degree of refractive error, by means of images, assisted by movements of parts of an appropriate instrument, then to verify the same by means of lenses used in the test, singly or in combination as the case may be.

LATRINE.—E. B. BARTLETT, care of American Foundry & Furnace Co., Bloomington, Ill. This invention pertains to latrines for use in public buildings, such as schools, hospitals, depots, and the like. The object here is to maintain a more uniform and continuous supply of water to the inclined sides of the body portion, and to positively prevent the passage of paper or the like into the ventilating duct.

BREAST SUPPORTER.—AUGUSTE SCHWENKLER, nee DEEGE, Berlin, Germany. As well known, the female breast is apt to suffer alterations by various causes, so that it becomes slack and hangs down, or it does not develop, and consequently the body necessarily loses in beauty. This invention relates to a simple appliance for improving upon the breast, by raising it and giving it the necessary elasticity and strength, in other words, by returning it into its normal position and giving the rounded shape.

NON-REFILLABLE BOTTLE.—J. S. BROMHEAD, 396 Dean Street, Brooklyn, N. Y. This invention relates to non-refillable bottles, shown and described in the letters patent of the United States, formerly granted to Mr. Bromhead. The object of the present patent is to provide a bottle which is simple and arranged to permit a free outflow of the contents of the bottle on tilting the same and to prevent the refilling of the bottle by unauthorized persons after the bottle is once emptied of its original contents.

AUTOMATIC HANGER.—AMZIE A. TEETS, 234 Essex Street, Brooklyn, N. Y. In this patent the invention has reference to an improved form of hanger or carrier, which can be automatically locked in position or automatically released at the will of the operator. The invention is applicable as a hanger for an electric arc lamp, but it may be utilized for and is applicable to many other useful purposes. It may be used as the supporting carrier for any object which is desired to raise and lower and support at any determined point.

PACKING SHOE.—G. MEYER, care of Louisiana Real Estate and Development Company, Shreveport, La. The device in this invention involves an improved form of packing shoe, especially adapted for use in well boring, and the object of the inventor is to provide an improved shoe, which when placed within a well bore will prevent leakage into the bore.

DENTAL DISK HOLDER.—J. A. PRESCOTT, Steele, N. D. In this patent the improvement has reference to dental disk holders, and the object thereof is to provide a simple and inexpensive device whereby in a single structure means may be provided for conveniently holding in accessible position a supply of disks of various sizes.

ALINING PLATE FOR FLOOR HINGES.—O. KATZENBERGER, 215 West Huron Street, Chicago, Ill. An object of this invention is to secure registry between the free vertical edge of the door and the central portion of the door jamb when the door is in closed position, without depending on the screws in the floor plate for the proper adjustment.

PROCESS OF PRODUCING SULFUR DERIVATIVES FROM GLYCERIN.—L. LILIENFELD, 1 Zeltgasse, Vienna, VIII, Austria-Hungary. This process is carried into practice by subjecting halogenhydrins to the action of stoichiometric quantities of, or an excess of inorganic sulfids, preferably alkaline sulfids, in a dry or powdered state, but preferably dissolved in a suitable solvent, such as water, alcohol or the like. Reaction may take place cold or under the action of heat, and the reaction itself produces heat.

MINE ALARM INSTRUMENT.—H. W. LEE and G. H. WEEDMAN, Mount Morgan, Queensland, Australia. The object here is to provide a speedy and effective alarm, to be actuated electrically or otherwise, for the purpose of, in case of ground falls, warning miners who are in or upon the mine, or for like purposes. The slightest movement in the ground can be immediately signaled by means such as alarm bells or electric lights, or both, in or to the various parts of the mine.

MAIL CARRIER'S BOX.—J. A. KILPATRICK, 929 South Eighth Street, Fort Dodge, Iowa. The object of this inventor is to provide a mail carrier's box for use on rural mail routes, to safely and conveniently contain mail matter, stamps, money orders, envelopes and the like, and to permit the delivery and transfer of the mail matter to its destination without danger of being lost, soiled or mutilated.

FENDER.—J. M. W. HEITMANN, Antonistrasse 12, Hamburg, Germany. In making fenders used upon shipboard, it is customary to place upon a core a number of layers of network, each row of the network having meshes looped into the preceding row. Mr. Heitmann employs a flexible winding member of spiral form, which may consist of rods, reeds, canes or strips, and around this twines a flexible member formed into meshes and connecting together the different loops of the spiral winding member.

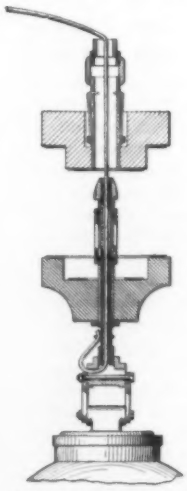
ELECTROPLATING PROCESS.—F. J. MCELHONE, 109 Van Winkle Avenue, Jersey City, N. J. This invention relates to electroplating or electrotyping. The object of the inventor is to provide a process for improving the conductivity of the coat of the case or mold and to overcome the tendencies in the graphite to produce pin-holes and similar defects.

POINT FOR CONCRETE PILES.—A. MAST, Tempelhof, near Berlin, 105 Berlinerstrasse, Prussia, Germany. This improvement relates to concrete piles which are chiefly intended to be used for foundations in bad building ground. Such piles are preferably constructed in the earth itself by sinking a tube into the earth and then filling the same with concrete. The tube consists preferably of sheet metal and may have a circular, rectangular or other suitable section, a special point being provided at the bottom end. The former difficulty in the construction of the point is overcome in the present invention by forming the point from bent flaps of the tube, so that the tube and point consist of one piece.

SEAL FOR PACKING CASE.—S. STROH, 30 Allerton Road, Lordship Park, London, N., England. In this patent the object is to provide a seal for connecting a lid to a box of such form that the lid or box cannot be cut away along the edges of the seal to open the box without defacing the seal or leaving evidence of the seal having been tampered with.

CLEAT FOR SECURING ROOFING.—H. W. TOPPING, care of John A. Topping, 4168 Drexel Building, Chicago, Ill. These cleats when spaced apart will exert a continuous pressure along the edge of the roofing material, and also along a parallel line a distance therefrom, one of the cleats commencing to exert the pressure against the roofing material before the pressure exerted by another cleat diminishes. Quick drainage is secured, and as rain is permitted to flow immediately from the roof, the life of the material and the cleats is preserved.

AUTOMATIC HANGER.—A. A. TEETS, 234 Essex Street, Brooklyn, New York, N. Y. This invention relates to an improved form of hanger or carrier which can be automatically released at the will of the operator. A

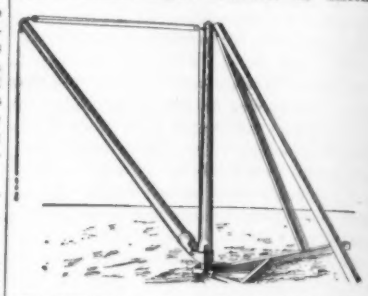


AUTOMATIC HANGER.

partial drawing (see engraving) is herewith shown as applied to an electric arc lamp, but this hanger may be utilized for and is applicable to many other useful purposes. The device can be economically manufactured, and in practice will be found certain, reliable and efficient for the purposes mentioned.

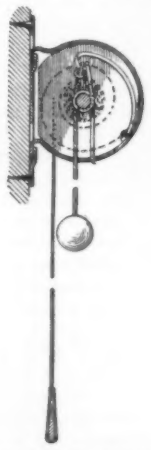
PENCIL.—H. REICHE, Millstone, N. J. The object here is to so construct the device that a flexible or plastic marking material may be employed. This material may be of such character that it operates to produce a mark without being moistened, or it may be of any soluble material and the pencil may deliver a moistening liquid to the marking material while the latter is being used. It may thus operate as an ordinary pencil or as a stylograph pen or as a fountain pen.

SELF LOCKING MAST STEP AND FOOT BLOCK.—R. H. BLACKBURN, 407 Bergen Avenue, Jersey City, N. J. This invention comprehends a mast step and a foot block admitting of general use, but of special service in connection with derricks and so disposed that a mast or boom is supported by them and adapted to turn into different positions, the parts being so arranged that when the mast or boom is in such position that the members mentioned might otherwise be disconnected from each other by virtue of the strain of the mast or boom, these members are rendered inseparable, but in another position they are easily separable. The engraving shows an elevation view of a derrick equipped with the Blackburn device.



SELF LOCKING MAST STEP AND FOOT BLOCK.

SHADE ROLLER APPLIANCE.—H. FORNELIUS, 3 Spring Street, Athenia, N. J. An object here is to provide a braking device for use with a roller whereby the shade may be maintained in any position desired throughout the length of the window. A further object is the provision of a device of the class



SHADE ROLLER APPLIANCE.

described embodying the features heretofore pointed out which will consist of the fewest number of parts, thereby enabling it to be produced at a low cost. The figure shown in the illustration gives a sectional view of the bracket, its casing and operating cords.

ATOMIZER.—E. J. MANNING, Janesville, Wis. The invention provides an apparatus wherein there may be transported liquid without fear of leakage; provides an apparatus which is convenient in shape and size for carriage in a pocket; and provides an apparatus which permits the separation of the parts for purposes of hygiene.

ADVERTISING MEDIUM.—G. T. FIELDING, JR., 575 Pelham Avenue, Bronx, New York, N. Y. In this case the purpose is the provision of a new and improved advertising medium for use in show windows, on roofs and other places, and arranged to successively display on a single figure different goods; for instance, several styles of shoes and hosiery, in a very attractive manner.

COLLAPSIBLE BOX OR PACKAGE.—A. E. BENDELARI, Webb City, Mo. This box is particularly adapted for holding and shipping beer bottles, but may be used for other analogous purposes. The box is made from a single sheet of paraffined cardboard, the same being adapted to fold in such manner as to provide interior projecting portions that serve as vertical, diagonal partitions that meet at the center of the box chamber and divide the chamber, or interior of the box, into four equal compartments, each of which is adapted to contain a bottle.

BUCKLE GUARD.—E. J. ELM, Funk, Neb. This guard is more especially designed for use on the buckles of the driving reins, to prevent the buckle from catching into fly nets, blankets and the like placed on the horse, and to prevent the mane or tail of the horse from becoming entangled, the guard being arranged to permit of readily placing it in position to extend over and form a guard for the point of the tongue of the buckle.

CURBING, ETC.—S. N. CORNWALL, 812 W. Mt. Vernon Street, Springfield, Mo. The aim of the inventor is the provision of a simple and inexpensive form of construction to aid in the laying of plastic curbing and the like which may be easily set up and taken down, may be used indefinitely and which will be capable of many adjustments for constructions of different size and shape.

INSECT ESCAPE FOR SCREENS.—J. R. KUNZELMAN, Mesaba, Minn. In this instance the invention has reference to screens, par-

ticularly door and window screens, and has for an object to provide an escape screen whereby flies or the like can find exit from a chamber and are prevented from entering the chamber from the outside.

COLLAPSIBLE CUP.—JENNIE L. FOLLETT, Adams, Mass. This cup is shown in the engraving in a vertical section, taken through the housings for the springs by means of which the cup sections are distended. The construction is of the collapsible sort which will not have to be touched with the hands when it is made ready for use. It is, therefore, always clean when used, as there is no

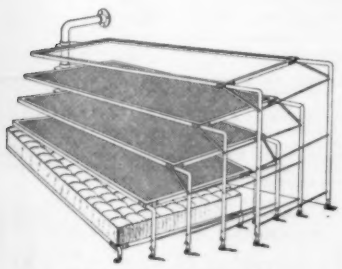
COLLAPSIBLE CUP.

chance that any dirt or dust upon the hands of the user will get into the water or other liquid which the cup holds. It is made in telescoping sections distended by springs, which are compressed when the cup is to be collapsed by means of a lid or cover and is locked thereby in position. The cover removed, the springs distend the sections and thus automatically make the cup ready for use.

LIFE SAVING APPARATUS.—M. OLSEN, care of WAHL & ROSE 410 Second Street, Eureka, Cal. For the purpose of this invention use is made of a line carrier having means for supporting it on the muzzle end of the gun and in alinement with the projectile fired by the gun, and a line attached at one end of the said line carrier so that when the gun is fired the projectile strikes the said carrier and carries it along and with it the end of the line.

DIRT RECEPTACLE.—A. H. HAVARD, Urbana, Ill. Mr. Havard's invention relates generally to receptacles for holding dirt and more particularly it involves a peculiar form of receptacle especially adapted for use by grave diggers, the form and construction of the parts being such that a device is produced which is of special use to persons engaged in such work.

DISPLAY MATTRESS RACK.—H. M. TAYLOR, 337 North Street, Baltimore, Md. The object of the invention, which is shown in the engraving in a perspective view of the mattress disposed on the lowest bed, is to provide a display rack the different parts whereof may be readily telescoped. The in-



DISPLAY MATTRESS RACK.

ventor attains this object by disposing a series of beds one above the other, all of which are pivoted to a standard and adapted to swing outwardly on the same, the end of each bed opposite the standard being supported by independent members, at the ends of which member are mounted bearings adapted to roll on the floor.

DESICCATING PROCESS.—P. BÉVENOT, 7 Rue Lafitte, Paris, and E. DE NEVEU, 42 Avenue Chevreul, Asnières, Seine, France. This invention has reference to the desiccating of liquid products, and is intended to be especially useful for the purpose of desiccating milk. By its means milk may be dried and preserved in such a way that it may be brought again to a liquid state simply by the addition of cold water.

### Hardware and Tools.

LOCK AND KEY.—J. LAUGHLIN, Ledyard, Iowa. The lock and the key are constructed so that the key may be inserted in any position when it will enter the lock and by further turning will operate it. The key may be withdrawn from the lock without the necessity of rotating it to its initial position. A guide way centers the key so that if the point of the key is inserted at any other angle than at right angles to the lock, it will be guided at once into position and upon further insertion and turning will operate the lock.

SWIVEL JOINT HOSE COUPLING.—J. H. BUNDY, Greenfield, Ind. The object here is the provision of a simple and easily operated coupling which while preventing accidental longitudinal movement of the sections of the coupling with respect to each other, will permit their free relative rotation, and wherein the sections may be easily connected and disconnected, without the use of tools.

WIRE SPLICER.—J. CRUMP, Loudonville, Ohio. In this case the invention is an improvement in wire splicers, and an aim of the inventor is to provide a simple, compact, and easily operated device of the character specified, for quickly splicing wires, and by means of which a splice may be made by one not necessarily familiar with the method.

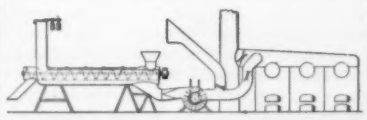
BOLT HOLDING PINCERS.—L. P. MOORE, Weldon, Ill. In this improvement a simple tool is provided in the form of a pair of pincers, whereby the head of a bolt and its neck may be gripped and held to prevent the bolt from turning while removing the nut from the other end of the bolt. Gripping blocks may be readily attached to a pair of pincers of ordinary construction, and thus provide means for holding the head of the bolt while removing the nut therefrom.

BELT PUNCH.—C. H. METZ, Spokane, Wash. This punch is provided with a peculiarly constructed point or cutting end which adapts it as a most efficient means for forming holes in belts and other articles. It makes a hole about twice the size of the core that is cut out. This is due to the taper on the outer side of the cutting edge. Thus less leather is cut out from a belt and the latter is not weakened at the point where the lace is applied and greater strain occurs.

BELT LACING TOOL.—C. H. METZ, Spokane, Wash. This invention is designed and adapted for use in punching belting and lacing or unlacing the same. The lace hook is formed with a wide or flattened bill; that is, it is fastened on the inner side to adapt it for contact with the lace without injury to the same. The bill also converges to a point to facilitate its insertion under a lace.

### Heating and Lighting.

COMBINED DRYING AND CONVEYING SYSTEM.—A. GNADT, St. Louis, Mo. This invention relates to a system for utilizing waste heat from a battery of boilers or the like, in drying any material, such as salt, saw-dust, or the like, while conveying it from one point to another. The system is readily accessible for the purpose of cleaning and manipulation. A further object is to provide means for con-

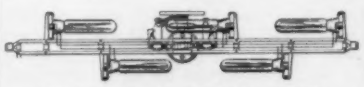


COMBINED DRYING AND CONVEYING SYSTEM.

ducting the waste heat from a heat-generating system, around a conveying member, and out of contact with the material being conveyed, so as to dry the material being conveyed, in a thorough and efficient manner. The accompanying illustration gives a diagrammatic view in side elevation of the system.

MATCHBOX AND IGNITER.—H. K. KISO, 214 East 20th Street, Manhattan, New York, N. Y. This invention relates to a combined matchbox and igniter, so constructed that the withdrawal of a match from the box lights it at the same time. The main object is to provide a neat, compact, inexpensive pouch in which may be carried matches, which pouch is so constructed that the withdrawal of a match will cause it to ignite.

MECHANISM FOR DIFFUSING LIGHT.—V. E. ELSON, 21613 Stair Street, Tacoma, Wash. Mr. Elson's invention relates to a mechanism for diffusing light, his more particular purpose being to provide a number of moving lamps and to so distribute and locate these lamps as to cause the light therefrom to



MECHANISM FOR DIFFUSING LIGHT.

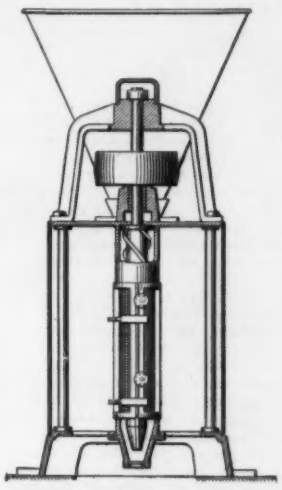
be diffused by aid of the so-called "persistence of vision." When an illuminating body is whirled rapidly around in a circle the eye observes what appears to be a luminious circle. His idea therefore is to cause the several lamps to each produce one of these illuminating circles and to have these circles apparently merge together, the result being that the light has the same effect as if it were radiated from a circular surface and were diffused uniformly or at least more nearly uniform than would be the case if the lamps were motionless. The rate of rotation of the lamps should be one seventh of a second to each complete revolution. The engraving shows a front elevation of the apparatus complete.

FENDER FOR GAS STOVE VALVES.—C. ZADIG and F. H. KAISER, New York, N. Y. Among the principal objects in view in this invention are: To provide a fender which may be removably attached to the gas supply pipe of a gas stove to prevent the striking or interference with the handles of the gas cocks, and to provide a fender which is durable and economical and simple in construction.

### Machines and Mechanical Devices.

RIVETING MACHINE.—H. LLOYD, 414 Fayette Park, Lexington, Ky. This improvement is in riveting machines, and the object of the inventor is to provide a simple, easily operated device of the character specified for setting a plurality of rivets, and wherein the rivet is utilized to form the opening for receiving the same.

GRAIN CLEANING MACHINE.—H. E. WALKER, Box 633, Honolulu, Hawaii. This machine removes husks or hulls from grains and frees them from admixed foreign substances, and has reference more particularly to a grain cleaning machine comprising a screen, a rotary member, means for feeding grain into space between the screen and the



GRAIN CLEANING MACHINE.

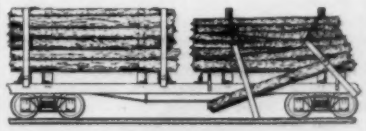
rotary member, and an adjustable retarding blade for regulating the movement of the grain, to determine the amount of attrition to which it is subjected. This machine is adapted for use on rice and other grains. It is compact in form, requires little power to operate it, and it works large quantities of grain in a comparatively short time, is easily taken apart and assembled and can be regulated for use with different grains and grains in different conditions. The engraving shows a vertical section of the invention.

METHOD OF FORMING ANGULAR CORRUGATIONS IN SHEET MATERIAL.—D. McR. LIVINGSTON, 159 East 36th Street, Manhattan, New York, N. Y. This invention has reference to certain improvements in the corrugating of sheet material, and more particularly to a method of bending sheet metal into a series of angular corrugations, each corrugation of which comprises three sides of a square or rectangle.

PUMP.—O. W. ALPHA, Franklin, La. This invention provides a pump of the rotary type, wherein the cylinder is caused to rotate at a high speed, the water being lifted by spiral wings or vanes, a portion of the distance, and by centrifugal force for the remainder. The liquid is drawn through the pump, and not through a separate casing, thus permitting the use of a shorter vane, and dispensing with the necessity of so much power.

### Railways and Their Accessories.

LOG CARRYING CAR.—W. A. HOLT, care of Holt Lumber Co., Oconto, Wis. The purpose of this invention is to provide useful improvements in log-carrying cars whereby the



LOG CARRYING CAR.

stake pockets and stakes can be turned in a transverse direction to lay the stakes flat down on the surface of the car body with a view to allow of running the car through a log loader requiring the removal of the stakes as now practiced. For the purpose mentioned use is made of a stake pocket pivoted on the car body to allow of turning the pocket to swing the pocket and with it the stake in a transverse direction to lay the stake flat on the car body. The car is pictured herewith in the illustration of its side elevation.

CAR BRAKE.—L. L. TYLER, care of Garvey, Kelley & MacMahon, 408 Equitable Bldg., Tacoma, Wash. This invention is an improvement in car brakes particularly of that class illustrated in the Warner patent, in which the brake staff is journaled in a support pivotally mounted so that the staff can be adjusted to either a vertical or horizontal position to enable the operation of the brake from the top of the car or from alongside the car. The present invention provides improvements in said construction.

### Prime Movers and Their Accessories.

THROTTLE VALVE FOR CARBURETERS.—M. WEIWODA, care of George W. Stevens, 25 Broad Street, New York, N. Y. In the present patent the invention has reference to throttle valves for use in carbureters, and more particularly to that type of valve in which an automatic dilution of the explosive charge may be secured. This is a division of Mr. Stevens's application formerly filed by him.

### Pertaining to Recreation.

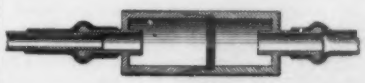
GAME APPARATUS.—C. SCHUTZ, 300 East 153rd Street, Bronx, New York, N. Y. In the present invention the improvement has reference to game apparatus, the more particular purpose being to produce a convertible game board suitable for use either as a shuffle board or as an alley for bowling or playing nine pins or ten pins, or similar games.

MECHANICAL TOY.—T. GENSMER, Portland, Ore. For the purpose of this invention, use is made of a handled bar, on the forward end of which is journaled a traction wheel connected by a pitman with a swinging figure fulcrumed on the bar, the figure being in the rear of a rotatable disk driven from the traction wheel and supporting picture cards in front of the figure.

AERIAL TOY.—E. T. OGDEN, Springfield, Ill. The invention relates to aerial toys, and more particularly to a toy which includes a buoyant gas containing envelop, a spinner located at one end of the envelop, and a runner at the other end, the latter serving to keep the toy headed into the wind.

### Pertaining to Vehicles.

GAS FILTER.—W. J. TINKER, Pierce City, Mo. This device relates generally to a filter and is particularly adapted for use in the gas supply pipe between the acetylene burner and the carbid tank in order to prevent the



GAS FILTER.

passage of water and dust into the burner, thereby choking it and causing the flame to go out. The object of the invention is to provide a device which will consist of few parts and which may be easily placed in position between the carbid tank and gas burner on an automobile, the construction being such that it may be conveniently attached to rubber tubing. A vertical sectional view of this filter is pictured in the engraving.

SPRING WHEEL.—E. W. BURNER, Luray, Va. This inventor provides a device which can be used in lieu of the ordinary wheel with a pneumatic tire, but which will absorb shocks in the same manner that a pneumatic tire does. A further object is to provide a device which may consist entirely of metal.

CLUTCH.—M. N. PRANGE, 237 S. Main Street, St. Marys, Ohio. The object here is to produce a combined disk and radial shoe clutch, particularly adapted for motor vehicles, so arranged that while traveling over comparatively smooth and level roads, the clutch engagement will be automatically maintained, and further, to provide means whereby when ascending a grade, one of these clutches may be brought into action to insure against accidental slipping of the clutch engagement, and further to provide means whereby both clutches may be instantly released.

VEHICLE WHEEL TIRE.—L. C. FLEMING, Tarrytown, N. Y. This invention pertains to tires having an outer casing or a shoe and an inner inflatable tube, and the aim is to provide a wheel tire for automobiles and other vehicles, and arranged to permit convenient opening of the outer casing for the insertion or removal of the inner tube without detaching the outer casing from rim of the wheel.

### Designs.

DESIGN FOR A PORTFOLIO COVER.—E. F. CALDWELL, Larchmont, N. Y. This ornamental design of a portfolio cover is oblong in form. The designs include a border effect broken at each corner by a man head. Scroll work interspersed with flowers and about a centerpiece in the middle of which shows a circle on which cherubim rest. Mr. Caldwell has designed another portfolio of the same shape, but with a very plain border. The ornamental effects are elaborate in respect to scroll work, heads, figures, and motifs, etc., around a centerpiece.

DESIGN FOR A DRINKING GLASS OR SIMILAR ARTICLE.—T. MORTENSON, Middletown, N. Y. This design of a drinking glass is of the small tumbler type, and is ornamented with a wildflower on a stem of leaves encircling the article in a very attractive manner.

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NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

## Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12629) C. T. L. asks: I have been told that I will not be burned if I place my hand on the bottom of a tea-kettle, immediately upon its removal from the stove, if it has boiling water in it. If this is true, what theory is involved, and why is not the bottom of the vessel as hot as the sides, or even the water? A. If the bottom of a kettle containing boiling water is well covered with soot from a wood or soft coal fire, it will be possible to place it on your hand without getting a burn. The kettle is as hot as the water it contains, and the bottom is as hot as the sides, but soot is a non-conductor of heat, and the hand is protected from the heat by it, just as it would be by a woolen cloth. We should not advise anyone to try the experiment unless his hands are about as tough as a hardy farmer's or a blacksmith's hands.

(12630) S. C. H. asks: In connection with the sinking of the "Maine," my attention has been called to the depth of water that was found for the submersion. I should like to ask two questions. In the first place, is it true that such a depth (1,000 fathoms) was available so near Havana harbor? And secondly, can you state what is the greatest recorded depth of the ocean, and where it is located? A. We know no reason for doubting the statement of the depth of the ocean where the "Maine" was sent to her final resting place; 2,000 fathoms is not very deep for the ocean. This is less than the mean depth of the oceans. The subject is discussed quite fully in the last edition of the "Encyclopædia Britannica." The greatest depth found is in the South Pacific, 5,155 fathoms, while in the Atlantic about 100 miles north of Porto Rico a depth of 4,561 fathoms has been found. A ridge exists along the middle of the Atlantic Ocean, where the depth is about 1,500 fathoms, while along the shores the depth varies from 2,500 to 3,000 fathoms. Much valuable information is given on this point in Tarr's "Physical Geography," which we send for $1.60.

(12631) C. H. H. asks: 1. Quite a number of years ago I saw in your publication a manner of tempering steel tools with lead. I cut it out, but it was destroyed by fire. Have you that formula now? Can't remember what color it should be before immersing in the lead. Should the lead be warm? A. In tempering with a metal bath, the bath is made up to melt at the temperature required by the article to be tempered. The bath is melted and the hardened tool is placed in the melted metal to be heated to its temperature. It is then cooled. You will find the formulas for various temperatures and the modes of working in our "Cyclopedia of Formulas," price $5. 2. Would you give latest soundings, general course, width, depth, temperature, in comparison with adjacent sea, and origin of the Gulf Stream in Atlantic, and what is generally termed Japanese Gulf or Ocean Stream in Pacific Ocean? A. The Gulf Stream originates from the great whirl of the ocean water in the torrid zone, called the Equatorial Drift. Some of this drifting water passes into the Caribbean Sea, and on into and around the Gulf of Mexico, emerging into the Atlantic, past the southern end of Florida. This part is the Gulf Stream. Off Cape Hatteras it turns to the right by reason of the deflecting action of the earth's rotation, and passes off into the Atlantic Ocean. The other portions of the Equatorial Drift are outside of the Gulf Stream, pursuing a course in the same general direction, and curving back toward the south to make another circle of the ocean. Some geographers still say that the Gulf Stream reaches to the shore of North Europe, but others hold the view that this river in the ocean is lost before the middle of the ocean is reached, and the mildness of the climate of Europe is to be explained upon more general principles. Off the Yucatan peninsula the Gulf Stream is about ninety miles wide and six thousand feet deep, flowing with a velocity of about a quarter of a mile an hour. At Key West its velocity is from four to five miles an hour, its width fifty miles and its depth about twenty-one hundred feet. The change in its width and depth produces its greater velocity and causes the flow to be maintained to a greater distance through the North Atlantic. Off the Banks of Newfoundland its flow is less than half what it is off the Florida coast. Billsburys "Gulf Stream" gives the most complete discussion of this subject. This treatise is included in the 1890 Report of the Superintendent of the United States Coast and Geodetic Survey. If you desire a copy we can procure it for you. We are unable to advise you definitely what the cost would be, but are of the opinion that it could be obtained for about $2.50. We have no detailed account of the Japanese Current.

## NEW BOOKS, ETC.

PHOTOGRAPHING FLOWERS AND TREES, AND DECORATIVE PHOTOGRAPHY. By J. Horace McFarland. New York: Tennant & Ward, 1911. Price, 50 cents.

The brochure comprises two monographs which have been out of print for some years. So entirely charming are the plates of trees and flowers, and so artistically suggestive and satisfactory the calendars, book covers, and menu cards, that the reprint will be welcome to all lovers of the beautiful, and particularly to those who strive to reproduce and interpret Nature by means of the camera.

ARE THERE EQUINOCTIAL STORMS? Development of the Marine Barometer in American Waters. By John H. Morrison. New York: Press of William F. Sametz & Co., 1911. 16mo.; 21+30 pp.

Two brief essays, only mechanically connected, and of very unequal merit. The first deserves attention in these columns only because it gives us an excuse for a plain statement regarding the much-befogged subject of the equinoctial storm. We would answer the question which Mr. Morrison puts on his title page by saying "Yes and no." As a name for any period of stormy weather occurring in the transition time between winter and spring, or for the more definite and intense disturbances of early autumn which, beginning as West Indian hurricanes, sweep up our Atlantic seaboard, "equinoctial storm" is exactly as convenient and appropriate as the name "Easter lily," applied to a plant that blooms in the early spring, but not exclusively on Easter day. The fact that these storms can have no conceivable connection with the sun's "crossing the line," and that they are, in fact, no more frequent on the particular days of the vernal and the autumnal equinox than at any other time within several weeks of those dates, has been so fully demonstrated by persons much better situated than Mr. Morrison for discussing meteorological questions that we feel he has wasted his time in exploring the records of a particular station to prove the already proven. As to the American "equinox," a far more conclusive demonstration was given by Prof. Hazen in the *Monthly Weather Review* for November, 1889; while the British "equinox" was effectually disposed of by Dr. R. H. Scott in the *Quarterly Journal* of the Royal Meteorological Society for October, 1884. As to educating public opinion on this subject, we believe that any attempt to do so is a hopeless undertaking. The brief history of the marine barometer is a decidedly interesting contribution to a little-known subject.

AERONAUTISCHE METEOROLOGIE. Von Dr. Franz Linke. II. Teil. Frankfurt a.M.: F. B. Auffarth, 1911. 8vo.; pp. viii, 126; illustrated. Price, 3 marks.

The first volume of this excellent little work on "aeronautical meteorology"—a new branch of applied science—was reviewed in the SCIENTIFIC AMERICAN of June 24th, 1911. The second volume completes the author's task of imparting such meteorological knowledge—and only such—as is of practical interest to the aeronaut. It is remarkable how closely Dr. Linke has adhered to his theme. For example, the opening chapter of the volume now under review deals with clouds. First is given the international cloud classification, with the familiar descriptions of cirrus, cirro-stratus, cirro-cumulus, etc.; then follow the methods of measuring the height and movements of clouds from the earth; then a few paragraphs on the mechanism of cloud formation and dissipation. At first the aeronautical bearing of all this does not appear; but presently the author begins to apply this fundamental information to the special subject of his treatise, and we soon realize that a thorough knowledge of clouds is almost as valuable to the aeronaut as a knowledge of the winds themselves. Thus the cumulus means strong ascending air currents, and its vertical extent is so great that the balloonist can hardly hope to rise through it. Certain developments of cumulus, moreover, foretoken thunder squalls, and warn the aeronaut to seek *terra firma* without delay. On the other hand, stratus clouds are associated with horizontal air currents and are so thin as to be easily penetrated. Rising above them the aeronaut finds himself in a relatively warm and stable stratum of air. Even the fact that the typically broad and continuous sheet of stratus shuts off the view of landmarks beneath is not so unfavorable as one might suppose; for the author tells us—and illustrates his thesis with a striking photograph—how, to the practiced aeronaut, the configuration of the land is often distinctly traced in the clouds; long rifts indicate the presence of river valleys beneath them; elevations in the cloud layer betray the location of mountains. So in the other chapters. The next deals with the stratification of the atmosphere; a subject that has recently assumed great importance in the general literature of meteorology. From the aeronautical standpoint it is no less interesting; for the boundary planes between air strata are regions in which the balloonist may sail for hours with little change of altitude. The next chapter treats of weather charts and forecasts. Several typical weather maps are shown, and each is accompanied by practical hints addressed to whoever may undertake an aerial journey under the conditions depicted. The author tells us how to organize a special thunderstorm-warning service for aeronauts; a field of work in which he himself was the pioneer. The new aeronautical weather service of Prussia is also described. Of the two remaining chapters, one deals with the mechanism of squalls, thunderstorms and tornadoes; the other with optical phenomena. The seldom described phenomenon of the pseudhelion is illustrated with a fine photograph by Alfred Wegener—which unfortunately is printed upside down. The other photographic illustrations of this work are admirable, and many are decidedly novel.—C. F. TALMAN.

## First Hydro-aeroplane Meeting at Monaco

(*Concluded from page 356.*)

The meeting was interesting as it initiated into the field of hydro-aeroplaning those three pioneers, Farman Brothers and Louis Paulhan. Both Henry and Maurice Farman had machines in the meet. The former made a number of flights in his hydro-aeroplane (which was piloted in the meet by Fischer) and gave M. Louis Blériot his first taste of this new sport. Neither Blériot nor any other monoplane constructor, however, had a machine in the meet. This is rather singular when we consider that the first aeroplane to rise from the water was the monoplane of M. Fabre, just over two years ago. We understand the Borel firm, of Paris, has lately brought out a monoplane with floats.

The Farman machines entered were two large biplanes fitted with long, twin floats very similar to those used by Curtiss. Renaux in the Maurice Farman biplane is shown flying with two passengers in one of our illustrations. This huge machine having a 65-foot spread is capable of carrying 8. It succeeded in getting off the water with its pilot and four passengers, a total weight, including fuel, of about 540 kilograms (1,170 pounds). The Curtiss machines were not adapted to passenger carrying, although Robinson succeeded in flying with a passenger several days and in going through the necessary trials. He had previously demonstrated the capabilities of his machine in rough and windy weather, so that the Curtiss hydro-aeroplane showed itself superior to the hastily contrived French machines. Neither of the Farman biplanes had flown before as hydro-aeroplanes. When Renaux made his first attempt he left on the wheels. Not until he had removed these after 3 days experimenting was he able to get off the water.

The Caudron biplane, fitted with Fabre floats and a 6-cylinder 70-horse-power Anzani motor, is shown in one of our illustrations. This machine, piloted by René Caudron, rose from the water very easily, but was not adapted to passenger carrying. Its record for starting was 11 seconds. The most powerful machine in the meet was the Sanchez-Besa biplane of Benoist. This was provided with a 110-horse-power Salmson motor, which had stationary, circular-arranged, water cooled cylinders. At first Benoist had difficulty in getting off the water, but he finally succeeded in doing this readily and in making some excellent flights.

Colliex, with his Voison "Canard," was the only experienced French hydro-aeroplane pilot. This machine, which we illustrated nearly a year ago in these columns, is a tailless biplane with motor and propeller at the rear and a long body projecting far out in the front, and carrying horizontal rudder or elevator, at its forward end. Colliex made a number of good flights, in some of which he carried three passengers. Unfortunately, on the 27th of March, while skimming over the water with his mechanic and 70 kilograms of ballast, the great leverage of his front elevator caused the head of his "Duck" to lift suddenly when struck by a gust. The machine was exposed to the wind at such a steep angle that the air pressure collapsed the left end of the main planes and the biplane fell in the water like a wounded bird. Another "Canard" was broken up when alighting on the rough sea the second day, while Robinson was able to fly readily despite the 4-foot waves. On all other days the weather was exceptional and the sea perfectly smooth. Had it not been for this the huge French biplanes would not have been able to fly.

As the prizes in the contest were for weight carrying rather than speed, the huge Farman machines naturally were the winners. Renaux tried removing the rear float from beneath the tail, but this did not improve the speed of his machine perceptibly. He made a 27-minute flight with a photographer who carried a cinematograph camera. The results of the meet were as follows:

1. Fischer (H. Farman biplane, Gnome motor), 112.1 points.
2. Renaux (M. Farman biplane, Renault motor), 103.8 points.
3. Paulhan (Curtiss biplane, Curtiss motor), 86.3 points.
4. Robinson (Curtiss biplane, Curtiss motor), 71.9 points.


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5. Caudron (Caudron biplane, Anzani motor), 65 points. The first, second and third prizes were $3,000, $1,500, and $500.

Eight different governments, including Japan, Brazil and Russia, sent represenatives to this meet to report fully the progress shown in the hydro-aeroplane, and it is probable that as a result of the demonstration a number of these governments will buy machines of this type for naval use. Russia has already ordered three Curtiss machines.

The only monoplane that made its appearance was a Deperdussin piloted by Laurens, which flew from Nice to Monaco and back in 21 minutes, carrying as a passenger Miss Fitzhugh. This happened the last day of the meet, which was followed immediately by the motor boat races, from the 3rd to the 15th of April. No less than 179 boats were entered this year in the motor boat races, and a total of $24,000 was offered for prizes. The Aero Club of America will hold a hydro-aeroplane meet in the Hudson River on May 4th. The Aeronautical Society has secured grounds at Bergen Beach so that its members can experiment with hydro-aeroplanes this summer.

## Girdling the Globe by Wireless

*(Concluded from page 860.)*

Hawaii has been called the "Key to the Pacific," and at Pearl Harbor the United States is constructing a great naval base. Independent wireless communication with Pearl Harbor is, then, of the most vital importance. The Hawaiian station will also serve as a relay point.

From Hawaii to Guam is the next link in the chain. Guam already possesses considerable importance as a United States coaling station, and thence to Luzon is, figuratively speaking, but a step. On the island of Luzon is the city of Manila, the capital of the Philippines. The Luzon station will be within easy communication with points on the coast of China and Japan.

The project also includes the construction of a powerful station on the island of Tutuila, one of the American Samoas. There is no cable station at this point, and the one nearest to Tutuila is under British control. These considerations were chiefly responsible for the selection of Tutuila as a site for one of the giant wireless stations. It may also prove desirable as a means of linking Guam and Hawaii, should adverse conditions impair wireless communication between those points.

The construction by the Navy Department of this chain of wireless stations will make the United States the proprietor of a system of communication girdling more than half the globe. The Government will then be independent of the commercial telegraph and cable companies, in war and in peace. The advantages of the system can hardly be overestimated. For example, Rear Admiral Murdock, commanding the Asiatic fleet, now on duty in Chinese ports, sends to Washington by commercial cables daily reports on the developments in the Chinese revolution and the steps he is taking to protect Americans. This method is both expensive and slow. Were the chain of wireless stations in operation, Admiral Murdock could send his daily reports without any expense, and with greater speed. The advantages to the Navy Department are equally apparent. It is not proposed to abolish the less powerful stations now in operation under the Navy Department control on the United States coasts and in the Pacific, with the establishment of the giant stations. The ships of the fleet, though capable of receiving messages at a 3,000 mile radius, have a maximum sending range of about 1,000 miles. Therefore, in many cases, the warships will be obliged to relay messages through the nearest small station, or through one another. The low altitude of the highest point on even the largest ships seems to have put a permanent limitation upon the sending power of wireless stations on shipboard.

On "freak" nights, that is, when conditions for wireless communication are abnormally good, naval wireless stations already in operation are accomplishing many of the feats which will be matters of routine when the big stations are erected. These "freaks" occur only at night, for, as is well known, wireless communication is more difficult by day, owing to the absorption of the electrical waves in sunlight.

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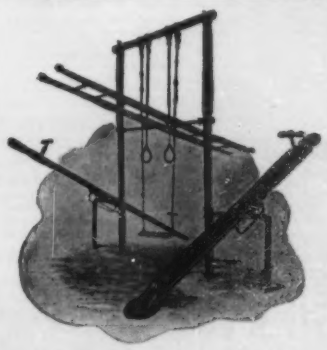

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during the night when both the "Salem" and the "Prairie" were searching the Atlantic for the destroyers in distress in the fearful storm which broke up the fleet on its recent trip to Guantanamo. On the same night the San Francisco operator heard the operator on the battleship "Florida," then near Galveston, Tex., sending "Good night." He also talked with the operator at Colon, on the canal zone, and heard the station at Cape Cod sending news dispatches to Europe. Only a few days ago, in a test, a message was sent from Hawaii to San Francisco, and thence to Key West, Fla.

These feats, however, are now regarded as merely accidents, and not to be expected regularly with the present height and equipment of the naval wireless stations. To make these, and even more notable feats, every-day matters, is part of the purpose of the proposed scheme.

## Panama—Personal Impressions

*(Concluded from page 363.)*

dam across the Chagres valley at Gatun. This dam is nothing more nor less than a huge artificial hill, whose width across the base, measured up and down the valley, is some 2,000 feet, and whose top or crest is 115 feet above the bottom of the valley. The dam has been built up by constructing across the valley two parallel embankments, formed of rock which has been hauled by the train load from the heavy excavation through the Culebra Mountains and elsewhere, and then filling the space between with closely compacted and impervious silt, which has been pumped up by hydraulic dredges and allowed to settle between the big rock fills, which form the upstream and downstream "toes" of the dam.

The waters of the Chagres are at present slowly backing up in the Chagres valley, and the water level will rise against the dam until it reaches an ultimate elevation, normally, of 85 feet. At this level the water will spread out far and wide over the valley of the Chagres and its tributaries, and create a veritable fresh-water inland sea, having a total area of about 164 square miles. The depth of the lake at the dam will be 85 feet. The floor of the valley along the route of the canal rises so slowly that no excavation of any quantity was necessary throughout the first 16 miles from Gatun dam. Just beyond San Pablo sundry high points of land in the valley had to be cut down. At Gamboa, 7 miles further up the valley, the great cut through the Culebra mountains commences. The bottom of this cut will be finished up at 40 feet above sea level, or 45 feet below the normal 85-foot surface of the lake. The Culebra cut extends for approximately nine miles, to Pedro Miguel, on the Pacific side of the divide, which may be regarded as the southerly limit of Gatun Lake, the total distance along the line of the channel through the lake being about 32 miles. Here there will be a single lock which will lower the ships from the 85-foot to the 55-foot level, where they will enter a small lake formed by a dam and spillway. A mile and a half of steaming through the lake will bring shipping to a double flight of locks at Miraflores, through which vessels will be lowered 55 feet to mean sea level on the Pacific.

It should be noted here that the tide rises 10 feet above and falls 10 feet below mean sea level on the Pacific; whereas on the Atlantic side the rise and fall above and below sea level is only about one foot. From Miraflores locks the canal will extend at sea level 8 miles to deep water in the Pacific.

Now the problem, as far as the Chagres River is concerned, has been to excavate through the Culebra hills and build the Gatun dam and locks upon such a plan that the furious floods of the river would not interfere with the progress of the work or destroy that which already had been done. At Culebra no difficulty was experienced until the excavation had been carried below the level attained by the crest of the Chagres floods. As the Culebra excavation has been extended below the river level the river has been controlled by the construction of a dam across the canal, above the point where the Chagres enters the prism of the canal. At Gatun, the first work to be done was to excavate through the rock on the eastern side of the valley a vast rectangular basin, in which to build the locks, and to open through the hill of rock in the center of the valley another excavation in which to build the spillway. This done, there followed the concrete work for locks and spillway, which has progressed with practically no interruption and at a rate of speed which has passed far beyond any records of work of this kind in the history of engineering, an average for one year of over 3,000 cubic yards of concrete laid per day having been achieved on the Gatun locks, with a maximum record for one day of over 4,200 cubic yards.

Simultaneously with the construction of the locks and the spillway the work trains were building the Gatun dam, and as soon as the spillway channel had been concreted the Chagres River was diverted through the artificial channel thus formed.

The spillway consists of a dam whose crest is 69 feet above sea level, and a line of vertical steel gates, which slide between concrete piers erected upon the crest of the dam. The top of the gates is 87 feet above the sea level. An impression of the present condition of the spillway may be gathered from one of the illustrations in which a portion of the dam is shown carried up to full height (+ 69).

For several months there has been no flow of the Chagres through the dam, and through the past dry season the lake level has slowly risen to an elevation of about + 20 feet above sea level. The rainy season with its heavy floods is at hand, and the rise will be rapid from now on. To prevent the possibility of the lake rising above the level of the lock floor before the lock gates are completed, the spillway is provided at its base with several temporary sluiceways, through which the water can be spilled if it should become necessary.

Future visitors to Panama will be startled when they enter Gatun Lake to find that the virgin forests in the bed of the lake have been left untouched. Here and there and particularly in the tributary valleys, the tropical jungle will lift its head above the waters. The question of clearing the Gatun basin of timber and vegetation was considered; but vegetation will do no harm, and as its removal over the whole 160 square miles would cost probably over a million dollars, it will be left in place. The various towns and villages in the basin, however, are being removed, and with them will be destroyed the visible record of several interesting links in the chain of early Latin-American history.

The water supply for lockages during the three months of the dry season will be ample. During the wet season the lake will be held at 87 feet above sea level. At this level there will be 47 feet minimum depth in the channel. But 41 feet is sufficient for navigation. Evidently the level may fall five feet without hindering navigation. Hence the storage available for losses by lockage, evaporation, etc., is a five-foot depth over 160 square miles—more than sufficient for the largest number of lockages that could possibly be accomplished during the whole dry season.

## One of the "Ten Stories"

*[Many of our readers have doubtless heard of the "Ten Stories," a little book containing true narratives of scientific events in which the* SCIENTIFIC AMERICAN *played a predominant part. It has been quite impossible to meet the demand for the "Ten Stories." Accordingly, they will be republished, one at a time, in these columns, for the benefit of those readers who were unable to obtain a copy of the original booklet.*—EDITOR.]

## Steinmetz May Smoke

WHEN Steinmetz writes anything of general interest the SCIENTIFIC AMERICAN eagerly publishes it, and all who have to do with electricity as eagerly read it.

When Steinmetz first went to the General Electric Company plant at Schenectady, his genius wasn't fully recognized. In those days Steinmetz was once working over a drawing board with a long black cigar in his mouth.

"You can't smoke here," said a man of authority, "it is against the rules for anyone to smoke in the General Electric plant."

Steinmetz looked at the man in sheer amazement. He didn't even take the trouble to ask how they could expect any man to solve difficult problems without smoking. The next day and the next Steinmetz failed to appear. At that time the whole engineering staff was engaged upon a problem which for many days and


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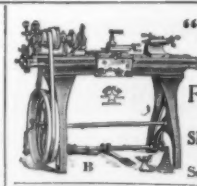

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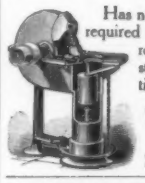

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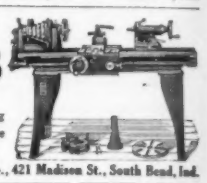

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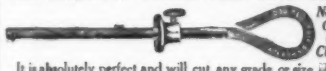

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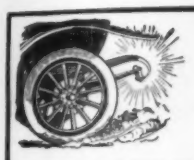

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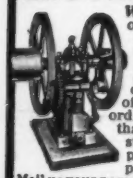

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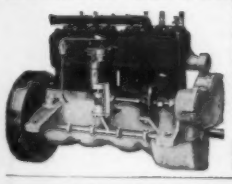

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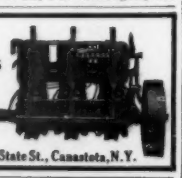

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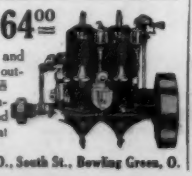

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possibly weeks had defied solution. Finally somebody remembered that Steinmetz had not been asked to tackle the knotty point. They found him at home. They asked him why he was not at the plant.

"What is the use?" he demanded. "I can't smoke, therefore I can't work."

They gave Steinmetz the problem. In a few hours he had worked it out.

The next day it was officially and authoritatively announced that Steinmetz could smoke anywhere he pleased and as much as he pleased.

There are many men in the industrial world who make a profession of inventing and of whom the general public never hears. Mostly they are engineers of the highest technical training, who are really great scientists. But their identity is merged into that of the great corporations who pay them princely salaries.

The epoch-making inventions which have changed the daily life of individuals, which have developed a new civilization, have been made mostly by farmers and mechanics who knew nothing of the industry they were revolutionizing. It rarely happens that the original inventor can bring the epoch-making invention to the commercial perfection that means wealth.

Alexander Graham Bell, a teacher of deaf mutes, worked out the telephone idea, but his device was barely able to transmit speech. Edison was hired to make it talk. He produced the carbon transmitter which really made the telephone an efficient instrument. Since then others have vastly improved the telephone, such men as Dean, Carty and Scribner, of whom the world has never heard, but some of whom have taken out several hundred patents on telephones alone. They are always working years ahead. They must devise switchboards, determine upon central stations that will meet the requirements of a congested population long after they are dead.

The big industrial companies are always trying to anticipate the man with the revolutionary invention. When he does appear the big corporations do not welcome him, because, if his invention is introduced, it means the tossing aside of machinery that may be valued at millions of dollars.

On the other hand, the great corporation has called forth a class of inventions, countless little feeding devices and mechanical movements, which mean the saving of a few cents on a ton in raw material or finished product and hundreds of thousands of dollars at the end of the year. These little things are nearly always the invention of a group of men. Look at the name plate of a turret lathe, or a slot machine, and you will probably see listed a score of patents to protect it, not one of which, however, was granted for the machinery as a whole, but for some little lever or combination of wheels, that made it possible to produce the machine more cheaply than before.

### A Wireless Tuning Station

IN a letter published in the New York *Times*, Mr. John Hays Hammond, Jr., calls attention to a new wireless station which he is erecting, especially with the object of developing means of securing selectivity in wireless telegraphy. The station is being erected on the sea front at Gloucester, Mass., and will be one of the most complete wireless experimental stations in existence. Mr. Hammond writes:

"The aerial is to be supported by two towers 340 feet high set 350 feet apart. The power installation will comprise eight complete wireless telegraphic systems, and also a system for telegraphing and telephoning over a searchlight beam. There will be two specially constructed high-frequency alternators giving 100,000 alternations per second, and developing an output of two kilowatts. These machines will be used for experimental development in wireless telephony. There will also be two five-kilowatt motor generator sets, having a frequency of 1,000 cycles per second. These will be employed for experimental research in wireless telegraphy. There will be a one-half kilowatt 250-volt direct current generating set for use with arc telephony. Besides this there will be two sets of 120 cycles, one of three kilowatts, and one of one-quarter kilowatt; and a two-kilowatt sixty-volt direct current set for an induction coil set. Besides developing my patents for the attainment of selectivity, the station will be used for the control of wireless dirigible torpedoes."


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Pony riders carried messages from Missouri to California, nearly two thousand miles across mountains and deserts, through blizzards and sand storms, constantly in danger of attack by hostile Indians.

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Railroad and telegraph took the place of the Pony Express, carrying messages across this western territory. Today the telephone lines of the Bell System have done more, for they have bound together ranch and mine and camp and village.

This network of telephone lines, following the trails of the Indians, connects with the telegraph to carry messages throughout the world.

By means of Universal Bell Service the most remote settler is no longer isolated, but has become a constantly informed citizen of the American Commonwealth.

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# How public opinion has crystallized in favor of the

Cadillac

Public opinion, which favorably affects the fortunes of a man; or of a motor car; is of two sorts; one called popularity, and the other called reputation.

It has been our endeavor to earn for the Cadillac that permanent good will which arises out of confidence in the integrity of the product; and crystallizes in the thing known as reputation.

We have, as you know, aspired to something more for the Cadillac than that passing popularity which is conferred upon a man; or a manufactured product; as the result of agitation or advertising.

It is pleasant to have our faith renewed from time to time, in the wisdom of preferring reputation to popularity—and we want to share with you the latest evidence we have received that people really do seek out goodness; and reward it when they find it.

This evidence, which comes in the shape of letters from many Cadillac owners, tells why each one of them bought a Cadillac. It has been compiled in book form for your convenience if you desire a copy; and we shall try to tell you briefly herein what it has told us about the Cadillac reputation.

## The origin and growth of Cadillac reputation

We find, from these letters, that public opinion about the Cadillac began forming many years ago.

It had its source—as does the enduring reputation of any man or any measure—in the favorable impressions formed by a few people here and there throughout the country.

These few people were impressed by the dogged sturdiness of the old original Cadillac cars.

In the very first days, Cadillac reputation spread slowly, because it traveled by the stage-coach process—from lip to lip, and mind to mind.

But the volume grew with every good word it fed upon—from town to town; and city to city; and state to state; and finally from the new world to every civilized corner of the old.

Meanwhile the performances of the early type had been re-enforced by the standardization of the new.

Standardization, close workmanship, accurate alignment became the Cadillac keynotes. And whenever men gathered together to discuss the car, those were the characteristics they talked about.

And presently—in the early days—when the spoken word had taken root and borne fruit, it was supplemented by the printed word, which merely reported what the spoken word had already recorded.

And the printed word, talking to a million minds at a time, hurried the good repute of the car 'round and 'round the globe with the speed of the wireless telegraph.

In these letters from Cadillac owners is contained the history of the Cadillac reputation.

They explain why the Cadillac is so widely considered a car apart and above.

They explain why the Cadillac owner always compares his car with those of higher and highest price—not with those of like or lower.

They are worth reading for that reason.

And for that reason we quote excerpts from a few of them.

And we invite you to ask any Cadillac dealer for the book itself—or write to us.

**Cadillac Motor Car Co., Detroit, Mich.**

## Why I Bought a Cadillac

My experience covers a number of years with automobiles and I believe I have owned and operated every make of car of any consequence manufactured in the United States, several of them costing over $4,000. Since then I have purchased two Cadillacs for the same work and in my judgment they are far superior to any other car, regardless of cost.
*F. Fay Sibley, Tucson, Ariz.*

Its good reputation; everyone praised it highly. I soon satisfied myself that I would make no mistake in purchasing the Cadillac.
*H. Lempley, Jr., Eufaula, Ala.*

Having been in the auto and taxicab livery business for the past four years and having owned and used several different makes of automobiles and taxicabs, we find the Cadillac best suited to our needs on account of the economy of gasoline, repairs and durability. We do not think, from our standpoint, there is a car on the market that can be bought for $3,000 that is the equal of our Cadillac.
*Owen Auto and Taxicab Co., Los Angeles, Cal.*

I liked its looks. No one spoke ill of it. Automobilists praised it. Owners were enthusiastic. I have yet to meet a dissatisfied owner.
*Harry Tyler, Hartford, Conn.*

Because this car has given satisfaction to all my friends who own them. The construction and appearance appealed to me, and subsequent use has convinced me I made no mistake. *A. S. Hamilton, Trion, Ga.*

In passing, let me add, were I to purchase ten more cars for pleasure and all around touring purposes tomorrow, they would be CADILLACS. *Robt. J. Martin, Clifton, Ill.*

Because I understand machinery. It's the best car for the money in the world. I have run mine for six months without six cents for repairs. *Benj. H. Marshall, Chicago, Ill.*

I inquired of fifty Cadillac drivers and I was unable to find one man who was dissatisfied. I consider that it is worth as much as any $3,000 car that ever had wheels under it, and I would not trade it for any of them.
*C. W. Brown, Waterloo, Iowa.*

If I was going to buy another car tomorrow I would buy nothing but a Cadillac.
*W. C. Hindman, Topeka, Kans.*

One of the reasons was that upon consulting a number of car owners I found that the greatest number of satisfied owners had Cadillacs and that the cost of upkeep was low, a fact which has been proven to me since running my car. *H. D. Hager, Columbus, Ohio.*

I am now driving my fifth Cadillac. I made the last purchase because I found the other models in every way reliable and satisfactory.
*E. O. Bailey, Memphis, Tenn.*

Because I had never heard an adverse criticism of the Cadillac. A Cadillac owner told me he would buy Cadillacs if he had a dozen machines to buy. Now, after owning two Cadillacs, I would amend the above by saying if I needed a thousand autos I would buy Cadillacs exclusively.
*Edwin J. Burke, Pendelton, Ore.*

Knowing first of all the reputation of the Cadillac machine from the time the single cylinder car was made, and having seen Cadillac cars in many states, even in the mountains of Arizona, was enough recommendation for me to purchase one. *Pittsburgh, Pa.*

I ran this car over 13,000 miles at no upkeep cost and changed it for a 1910 when they came out. After running the 1910, 14,000 miles I changed for a 1911, which has run from Oct. 15th over 14,000 miles and going well.

That I have influenced several friends to secure the same kind of car thoroughly endorses my opinion of it.
*W. R. Eisenhower, Philadelphia, Pa.*

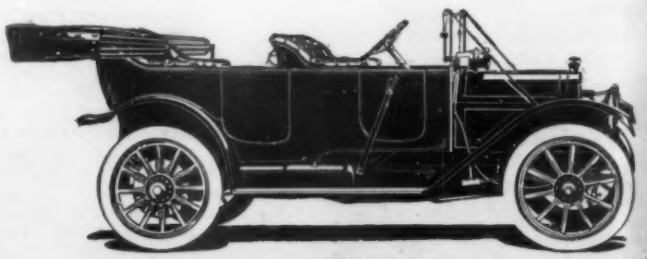
My car has been run 5,000 miles without the necessity of any mechanical repairing whatever; and as this is the sixth car that I have owned, and the only car that has not been a continual expense, from time of purchase, I can recommend it as the greatest American car built under $3,500 price.
*Harry S. Ebert, York, Pa.*

The reasons I bought a Cadillac are that from the experience I have had owning three Cadillacs and seeing others, that I considered it the best car made in America for the price and far better than some that cost a great deal more.
*W. H. Goodfellow, Altoona, Pa.*

I bought a Cadillac because after I had made a thorough investigation of the cars around its price I decided it was the best one in the lot, and my experience has proved that my decision was right.
*R. I. McDavid, Greenville, S. C.*

I was unable to find a car, at any price, that had any better equipment. I mean by this that the highest priced cars were using about the same tried principles, except the engine, which I think has no equal, and is in a class by itself.
*W. F. Roth, Gallatin, Tenn.*

I have just purchased my third Cadillac. I had a 1909 Model, used it fourteen months, sold it for $1,350 cash. I then purchased a 1910 Model, used it seventeen months, sold it for $1,200 cash; then I bought the present car—the best car in the world under $3,000—and as far as regular service and freedom from trouble goes, the best car in the world at any price. *Hugh E. Prather, Dallas, Texas.*



**TOURING CAR $1600**

**Other Models: Four passenger Phaeton $1800, four passenger Torpedo $1900, two passenger Roadster $1800, seven passenger Limousine $3250.**

**Prices F. O. B. Detroit, including standard equipment**